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ASPECTS OF FOREIGN TRADE.

The enormous magnitude of his home market has caused many an American manufacturer to be indifferent to the foreign market. At such times as these when production has at last overtaken the great domestic consumption, due to the purchasing power conferred on the people by a long period of expansion and prosperity, the foreign market comes into a position of more importance, and the true value of foreign trade is perceived by those who have been inclined to neglect and despise it. There are, moreover, many things we need abroad and shall always need, and such things will be more easily purchasable if we have been ready and willing to offer goods in exchange. It is only the rabid and impossible protectionist who either wants no foreign trade or else wants to do all the selling and none of the buying. Modern conditions of commerce and production do not permit of such sterile isolation, but aim rather at a steady large creation of goods that can suit all the markets most of the time. The true dividing lines are not frontiers or tariffs, but prices.

Secretary of the Treasury Shaw has just insisted in a speech at Boston that new opportunities of foreign trade should not cause us to be any less earnest in appreciation of the home market, but at the same moment he points out that we are now only securing 10 per cent. of the trade of South America, South Africa and the countries washed by the Pacific Ocean. This trade he sets at a figure of a thousand million dollars per annum. Other countries get the 90 per cent., but they are entitled to it on various scores, and for some of them, like Germany, the outlet has been a recent cause of great relief. The probability is that if our merchants and manufacturers went in for their proper share with the vim and acumen that distinguishes their drumming for the orders of Podunk and Skaneateles they would get it; and at the same time the total for foreign regions would be raised, so that all exporting countries would still benefit. One of the first and one of the lasting impressions of a visit to regions that must necessarily import manufactured goods and export raw products is the slight extent to which the possible interchange has been pushed. It is "neutral ground" in more senses than one. Mr. Shaw believes in subsidized ships, as an effective means of developing this oversea trade; but while a regenerated fleet of American mercantile ships is "a-borning" our manufacturers are not altogether destitute of ways and means for placing their goods at foreign thresholds, or for cultivating foreign knowledge as to what can be bought at advantage in the United States.

THE DUBLIN CENTRAL STATION.

We take pleasure this week in giving a description of the Dublin three-phase central station to which we have several times previously alluded. It possesses more than a passing interest, since Dublin is, if we mistake not, the largest city in which a pure three-phase distribution has been undertaken. Although the three-phase, four-wire system has been in use for some years in several American cities, like Sacramento and Salt Lake City, and with excellent results, these are small compared with Dublin, and do not, like Dublin, involve any material amount of underground distribution. The larger American cities were mostly equipped with Edison stations prior to the introduction of polyphase apparatus, and while this has been introduced to a very considerable extent, it has been quite uniformly for the purpose of transmitting energy to rotary converters feeding the old Edison networks. It is, therefore, particularly interesting to see an

unmitigated polyphase system tried on a large scale under the severe requirements of modern urban distribution. The three-phase star with neutral wire is, perhaps, upon the whole, the most promising alternating system for use upon a large scale. It is not quite so simple as a two-phase, four-wire distribution, but saves a large amount of copper, almost as much as an ordinary three-wire continuous current system, even with the large neutral used in Dublin. Broadly, all distributing systems which save copper by combining circuits involve in one form or another the question of balancing the load to insure uniformity of voltage. In the early days of the three-phase system great importance was attached to this matter, and it was an objection often strenuously urged. As experience has been acquired, the fear of unbalancing has sunk to its proper plane, and it has been found that with reasonable care there was little to fear.

On a distribution fully laid out for three-phase circuits, this load wandering can be deprived of its injurious tendencies; but where, as in part of the Dublin system, three old single-phase circuits are put in three-phase connection without any material change, there is a considerable possibility of trouble. This sort of thing can be successfully done in cases where it is a very small part of the total load, or where, as in wiring large buildings, the secondary drop is rather small; but it must be rather carefully watched, and should be worked over to a pure three-phase form when opportunity offers. The connections are a trifle more complicated in a three-phase system than in an ordinary three-wire system, but the difference is practically inconsequential, and, with due care, as good service can be given from one as from the other. Certainly, the new Dublin system will be a vast improvement over the old one, and we doubt not that the results will be highly satisfactory. We are interested to observe that the frequency is dropped in the new plant to 50 periods, which seems to be becoming rather the standard practice abroad. Here there is a double standard, 60 periods for general service and 25 periods for work with rotaries. Where many motors are to be used or where much of the distribution is to be underground there is a material advantage in dropping the frequency below 50 periods; but where lighting is to be done by the alternating current 25 periods is too low. Perhaps there is no single standard frequency that can be settled upon in general practice in view of the complicated requirements, but it would certainly be an advantage if the bulk of the work could be done at a medium frequency which would enable the bulk of the machinery to be available for all purposes. As it now stands, an enormous variety of machines are built to furnish a fairly complete line at each frequency in use, and without wishing the art to become hidebound through standardization, it would be a good thing if there were greater uniformity in the matter of frequency.

An Extraordinary Telephone Situation.

On several occasions our news columns have contained references to an extraordinary telephone situation in which Mr. Milo G. Kellogg and the Bell Telephone interests are principals, and we print elsewhere in this issue an abstract of a long statement just issued by Mr. Kellogg dealing with the matter. This statement is frankly *ex parte*, and final judgment as to the actual merits of the case must naturally await the presentation of the other side. According to the information now at hand, it appears that during an illness which totally incapacitated Mr. Kellogg, his controlling interest in the Kellogg Switchboard & Manufacturing Company, which company had been the principal competitor of the American Bell, was disposed of to a representative of the latter interest in virtue of a power of attorney which Mr. Kellogg, when he found that recovery of health required entire abstention from business affairs for a long and indefinite period, had given to an officer of his company. It was not until some months later that Mr. Kellogg, then somewhat recovered in health, learned of this transaction, and immediately took steps to regain control of the company, or come to an arrangement whereby he would be constituted a large minority stockholder and the balance of power placed with a party or parties satisfactory to both sides, the company then to engage only in the manufacturing business along strictly commercial lines. As an inducement to resell to him his former stock, Mr. Kellogg made an offer to purchase it at an advanced figure, involving a profit of about $100,000 to the present holders. These negotiations having resulted in entire failure, several months ago suit was instituted to obtain an order declaring that the sale of the Kellogg stock was an unlawful injury to the minority stockholders and in restraint of trade, and consequently illegal and void.

This strange case has been accompanied by a number of incidental complications. Some months ago an arraignment of the transaction which deprived Mr. Kellogg of his control was published over the signatures of some of the leading members of the staff of the Kellogg organization, who yet remain in the employ of the company under its new control. Though guarantees given by the Kellogg Company to all of its customers are in existence, whereby in the case of action for infringement that company or its successors shall defend the suit, actions have been instituted by the Bell Company against such customers since it has acquired the control of the Kellogg Company. As the two former contending interests appear now to be legally identical so far as such suits are concerned, it is interesting to know what view will be taken by the courts of the legal situation thus presented in case the suits are brought to trial. Still another feature is that since the Bell Company has been in control, contracts for switchboards have been taken from independent companies in competition with Bell licensees, and instruments sold outright to competitors of such licensees at a rate very considerably less than the annual rental paid by Bell licensees for similar instruments. Altogether, the suit which Mr. Kellogg presents is a most remarkable one as affecting himself, some of the present staff of his former company, the Bell licensees and the Bell Company as bound by guarantees given by the Kellogg Company.

Concerning "Cold Light."

A paper by Lenard in the current number of the *Annalen der Physik* gives an immensely interesting account of experiments on phosphorescence induced by cathode rays. The research in apparatus and methods is too intricate for full description here, but some of the results cannot fail to be of high importance to electrical engineers in calculating the possibilities of electric lighting. Lenard experimented with various phosphorescent materials subjected to a cathode ray bombardment. He estimated by very ingenious means the energy required for excitation, and measured photometrically the intensity of the light produced. It has been well understood that in such cases light is produced at a very high efficiency, but Lenard's result of *ten Hefner units per watt* is decidedly higher than anything heretofore reached. Five Hefner units per watt was claimed in some of the experiments on very high temperature electric arcs, and Tumlirz and Knute Angström, respectively, derived 5.3 and 8.6 units per watt as the mechanical equivalent of light based on the Hefner lamp. On general principles there is not the least reason to doubt the correctness of Lenard's figures, since the efficiency of the electric arc has been pushed into the same neighborhood at least; and the spectrum of such an arc certainly contains a very large amount of non-luminous radiation, while the spectrum of low phosphorescence, like that of the fire-fly, is very rich in luminous rays. It is, however, a very long step from demonstrations like that made by Lenard to the practical production of light at any similar efficiency. Lenard's tube was

small, the actual luminosity was small and all such methods as yet suggested require dealing with uncomfortably high voltages. The real surface brilliancy of the phosphorescent screens was so small that an impracticably large surface would be required to give a practically useful result, and all the work hitherto done tends to show that forcing the intrinsic brilliancy is likely largely to reduce the efficiency. The fire-fly still retains possession of his secret, and chemist and physicist alike have thus far failed to extract it from him.

THE ENERGY OF RADIATION OF THE HEFNER LAMP.

The last number of the *Physical Review* contains an interesting paper by Angström on the radiant power of the Hefner standard amyl-acetate lamp. The Hefner lamp is much used in the photometry of incandescent lamps, and has the advantage of consuming a hydrocarbon fuel of definite and readily obtainable density and constitution. It is also very nearly constant and reproducible. Its main disadvantage is its red color and low temperature by comparison with the ordinary incandescent lamp. The paper commences with an important generalization not generally realized; namely, that the spectra of hydrocarbon flames are all very similar, and consist of the continuous spectrum of incandescent carbon with the discontinuous spectra of gaseous combustion products superposed. The spectrum of incandescent solid carbon is always essentially the same for a given temperature, and is a continuous spectrum running from the ultra-violet to the far ultra-red. The spectrum of a gas is always essentially a discontinuous, or banded, spectrum. Some gases have spectra consisting of a few lines only. In a hydrocarbon flame, such as a candle flame, there is an inner core of heating gas, surrounded by a sheath of highly heated and incandescent carbon particles, emitting continuous spectra, which are again surrounded by a sheath of highly heated carbonic dioxide gas and hot water vapor. These incandescent vapors superimpose banded spectra on the continuous carbon spectrum. In the case of the incandescent lamp, the incandescent filament emits a continuous spectrum; while the cooler vapor of carbon or other substances which may envelop the glowing filament have negative band-spectra or tend to absorb the energy of the carbon spectrum, selectively, and at the bands of their own spectra.

According to this doctrine, if it were not for the mantle of glowing gaseous combustion products, which add, here and there, energy to the carbon flame-spectrum, and to the sheath of cooler vapors which deduct, here and there, energy from the carbon filament-spectrum, the spectrum of a flame would be the same as the spectrum of an incandescent lamp, provided that the incandescent lamp were adjusted by its current strength to have the same temperature as the flame. The paper then goes on to show that the spectrum of a certain standard Hefner lamp was found to be very nearly the same as the spectrum of a certain incandescent lamp, when the latter was operated at a somewhat low pressure, or operated at reddish color instead of bright white. In the spectrum of the Hefner, drawn with ordinates as radiant intensities, to abscissæ of wave lengths, there were certain superposed lumps at or near three particular wave lengths; while the incandescent lamp spectrum showed indentations or hollows, at these wave lengths. Otherwise the two curves seemed to agree very closely. The unindented curve of either luminous source appears to follow Wien's law. This law may be verbally expressed by saying that the immissivity, or reciprocal of the power emitted at any wave length, varies as the fifth power of that wave length, and also as the anti-logarithm of a quantity which is the reciprocal of the wave length multiplied by the absolute temperature of the source. From this law it follows by integration that the total power of radiation, for all wave lengths taken together, varies with the fourth power of the absolute temperature—the proposition known as Stefan's law. It also follows that the radiant power commences at zero for wave length zero, and increases as the wave length increases up to a certain critical wave length, at which the radiant power is a maximum, and then dwindles to zero as the wave length becomes indefinitely increased. The critical wave length becomes shorter as the temperature of the source increases; so that the more highly heated a body becomes, the more its heat is radiated in short waves. This is in accordance with the observed phenomena of luminescence. Wien's law is strictly applicable to perfectly black bodies only, or to bodies that have no selective color radiation; but the law is assumed to apply either to a Hefner flame or to an incandescing lamp filament without sensible error.

Angström found that the total intensity of radiation (both visible and invisible), in the horizontal plane, of his Hefner lamp, was 900 ergs per second at a distance of one metre from the flame centre. If the Hefner were regarded as a luminous point source distributing radiant energy equally in all directions, the total power would, therefore, be 11.3 watts of heat energy, or chemical energy of combustion, and with a mean intensity of 0.88 British candle, the value ordinarily assigned, to a Hefner lamp, the power absorbed would be 12.8 watts per candle. The thermochemical value of the amyl-acetate burned per unit of time is not stated, but would constitute a check upon this estimate. The luminous efficiency of the Hefner was measured and found to be 0.0096, or nearly one per cent. Consequently, the measured intensity of luminous radiation of the Hefner was very nearly 9 ergs per second per normal square centimetre at a distance of a metre; i. e., 90,000 ergs per second per steradian or unit solid angle. If the Hefner may be regarded as a luminous point source, emitting light uniformly in all directions, the total luminous radiant power was 0.11 watt. The incandescent lamp tested had a straight filament, and absorbed, at normal candle-power, 0.25 ampere at 16 volts, or 6.4 watts. Unfortunately, its luminous intensity under these conditions, in terms of the Hefner, is not stated. The total luminous intensity of radiation was found to be 20.9 ergs per second per normal square centimetre, at a horizontal distance of a metre, which corresponds to 209,000 ergs per second per horizontal steradian. With a total luminous radiation including all directions of 2,063,000 ergs, or 0.2063 watt, the luminous efficiency of the lamp would have been 3.22 per cent. The temperature of the Hefner flame was computed to be approximately 1830° C. absolute, or 1557° C. above melting ice zero. The temperature of the incandescent lamp filament at normal candle-power is stated to have been 2000° C. absolute, or 1727° C. above melting ice zero. If these values are reliable the extra 170° C. of the incandescent lamp is a sufficient elevation of temperature to change the color of the light from the reddish tint of the Hefner, to the incandescent whiteness of the ordinary glow lamp.

The chief value of the paper lies in providing a mathematical clue to the operations of an incandescent lamp. If the formula is reliable, it should be possible to compute the color, absolute efficiency, and temperature, of an incandescent filament, when its consumption in watts per candle is given. It is important that such measurements should be repeated on an incandescent lamp, together with the photometric values of the lamp in luminous distribution and mean spherical Hefners. Meanwhile, it is interesting to remember that a Hefner-lux, or Hefner-metre, is an illumination by a Hefner at a horizontal distance of a metre, and corresponds to an incidence of luminous radiation at the rate of nine ergs per second per normal square centimetre; or, since the watt is the practical unit of power and the absolute unit, or absolute watt, is one erg per second, the Hefner-metre is nine absolute watts per square centimetre.

Telegraph Tournament.

A telegraph tournament was held in Philadelphia on October 30 and 31, under the auspices of the American Telegraphers' Tournament Association, and it was unquestionably the most successful affair of the kind ever held. It was organized on a large scale and was liberally supported. The tournament was held in the auditorium of the National Exposition Buildings, and the large hall was crowded almost to suffocation on Friday and Saturday evenings. There were so many entries to the later events that the work was not finished until 5 o'clock Sunday morning.

Mr. J. C. Barclay, assistant general manager of the Western Union Telegraph Company, opened the tournament with a few appropriate remarks.

Following is a summary of the events and the names of the successful contestants:

Railroad operators' sending and receiving contest; sending and receiving 20 ordinary railroad messages; first and second prizes in each class, $50 and $25, respectively. Sending—First prize won by L. G. Bartley; second, G. A. Cone. Receiving—First, J. H. Harrison; second, G. Hodgson.

Ladies' contest; sending 20 commercial messages and receiving 20 commercial messages on typewriter. Sending—First prize, $50, won by Miss K. N. Stetson, of New York; second prize, $25, won by Mrs. B. V. Gillespie, of Philadelphia. Receiving—First prize, $50, won by Mrs. F. Feldman, of New York; second, $25, Miss L. McKenna, of New York.

Old Timers' contest, sending and receiving 10 messages and 300 words of press matter, won by I. D. Maize, of Philadelphia; E. P. Porter, of New York, second. The first and second prizes of this contest were $50 and $25, respectively.

Best all-around operator contest. Sending and receiving 25 messages and 500 words of press matter. First prize $300 and the Carnegie medal; second prize, $150. Won by W. M. Gibson, of New York; second, E. E. Bruckner, of Chicago. This concluded Friday's events.

On Saturday the first event was the Phillips' Code contest; sending and receiving 1,000 words. First prize in each class, $75. Sending, won by G. W. Conkling; receiving, F. M. McClintic, first; W. C. Murray, second.

Broker operators' contest; sending and receiving 10 minutes; first prize, $100; won by Harvey Williams.

Yetman transmitter special contest; sending and receiving press for 15 minutes; first prize, $50 and one Yetman transmitter in each class. Sending, won by C. P. West, of New York; receiving, J. P. Gallagher, of New York.

Championship of America contest; sending 500 words; first prize, $300; second, $150; won by Harvey Williams, of Philadelphia; G. W. Conkling, of New York, second.

Receiving commercial messages on typewriter for 30 minutes; automatic transmission; first prize, $200 and a Fay-Sholes typewriter; second prize, $100; won by J. P. Gallagher, of New York; second, H. V. Emanuel, of Philadelphia. The winner received 53 messages in half an hour.

There was an extra contest for a silver cup offered by the New York Consolidated Stock Exchange. The cup was won by G. W. Conkling, of New York.

The De Forest Wireless Telegraph Company gave a demonstration of the practical operation of its system. Signals were transmitted and received across the hall, a distance of about 100 ft. The various typewriter companies made large and tastefully arranged exhibits of their machines and distributed souvenirs and literature of special interest to telegraphers.

Among the judges of the various contests were: J. P. Altberger, superintendent Western Union Telegraph Company, Philadelphia; L. Lemon, superintendent Postal Telegraph Company, Philadelphia; J. F. Skirrow, electrical engineer, Postal Telegraph Company, New York; Fred Catlin, New York; C. P. Bruch, assistant general manager Postal Telegraph Company, New York; George H. Usher, superintendent Postal Telegraph Company, New York, and T. R. Taltavall, ELECTRICAL WORLD AND ENGINEER.

The Carnegie medal, which was won by W. M. Gibson, was held by F. M. McClintic, of Dallas, Texas. According to the terms of its donation it must be competed for annually. It is a handsome example of the jewelers' art.

Colorado Electric Railway, Light and Power Association.

The Colorado Electric Railway, Light & Power Association held its first meeting October 28 and 29 in the demonstration hall of the Denver Gas & Electric Company in Denver.

J. F. Vail, general manager of the Pueblo & Suburban Traction & Light Company, was in the chair as president of the Association. At the opening session over one-fifth of the membership was in attendance at the meeting.

The address of President Vail took up a portion of the time of Wednesday afternoon. It recited among other things the fact that the organization of the Association was made August 12 of this year, and that this was the initial meeting. There was no reading of papers in the forenoon, that part of the programme being passed over in order to take up general business and the reports of the several committees who were appointed to get the new association under way.

Among the 22 active State corporations with representatives at the meeting were: Durango Light & Power Company, Larimer Light & Power Company, of Fort Collins; Las Animas Electric Light Company, of Las Animas; Colorado Springs Electric Company, Leadville Gas & Electric Company, Boulder Electric Light & Power Company, Pueblo & Suburban Traction & Light Company, Las Animas Light, Power & Manufacturing Company, of Trinidad; Arkansas Valley Electric Company, of Florence; Gilpin County Light, Heat & Power Company, of Black Hawk; Denver Gas & Electric Company, Denver City Tramway Company, La Junta Electric Company, Greeley Electric Light Company, Crested Butte Water & Power Company, Roaring Fork Electric Light & Power Company, of Aspen; Loveland Light, Heat & Power Company; Lamar Electric Company, La Bella Mill, Water & Power Company, of Goldfield; Colorado Electric Power Company, of Canon City; Colorado Springs & Interurban Railway Company, and Pagosa Springs Electric Light & Power Company.

Among the eighteen associate members represented were: Albert Sechrist Company, Denver; E. C. Means, agent Adams Bagnall Company, Denver; Phelps Company, Detroit; Western Electric Supply Company, of St. Louis; National Carbon Company, Cleveland; Mutual Oil Tank Line, Omaha; W. A. Layman, of the Wagner Electric Company, St. Louis; Westinghouse Electric Manufacturing Company, of Pittsburg; and these of Denver: Gilbert W. Kes & Co., R. J. Cory, of the Allis-Chalmers Company; Thomas H. Smith, American Steel & Wire Company, and B. K. Sweeney, B. F. Vreeland, W. L. Otis and George A. Woolet.

In the afternoon Mr. L. C. Stockton addressed the meeting, his topic being "A Few Advertising Hints," and was followed by Mr. C. W. Humphrey, whose subject was "Meters." A question box was opened and much information imparted to those who wanted enlightenment from experts.

When the association met for the second day's session, Mr. W. A. Layman, of the Wagner Electric Manufacturing Company, of St. Louis, read a paper on "Single-Phase Motors as a Means of Increasing Central Station Earnings," after which Mr. L. L. Summers, one of the engineers of the Denver Gas & Electric Company, read a paper on "Steam Economics." The delegates then went into executive session to elect officers.

Mr. J. F. Vail, of Pueblo, was re-elected president, which office he has held since the organization of the Association last August. Mr. William Mayhu, of Greeley, was re-elected vice-president, and Mr. George B. Tripp, of Colorado Springs, was made secretary and treasurer to succeed himself. The members of the finance committee chosen were Messrs. F. F. Webber, Charles Beeley and L. J. Kelin. The membership committee consists of Messrs. C. W. Badgley, C. E. Doolittle and C. H. Peters, and Messrs. J. E. Lundstrum and J. A. Beeler were added to the executive committee. In the afternoon the members went on a trolley ride to the coal mines of the Denver & Northwestern at Leyden, in the private car of General Manager J. A. Beeler, of the Tramway Company.

Life of Radium.

Prof. Robert A. Millikan, of the University of Chicago, has recently formed a careful mathematical estimate of how long a particle of radium can last, and how long a time must elapse before a loss of weight can be noted. Thirty thousand years is found to be the maximum limit before the radium is completely disintegrated. A possible minimum of 300 years has also been calculated, but this is not regarded as probable.

Transmission of Hudson River Power.—III.

(*Concluded.*)

WITHOUT following out in detail the arrangement of switches and lines at the Saratoga and the Alplaus switch houses, it may be said in general that in each place either transmission line from a generating station may be connected to either line running to a sub-station.

The flexibility of the connections between the generating and sub-stations is further illustrated by the sub-station at Watervliet,

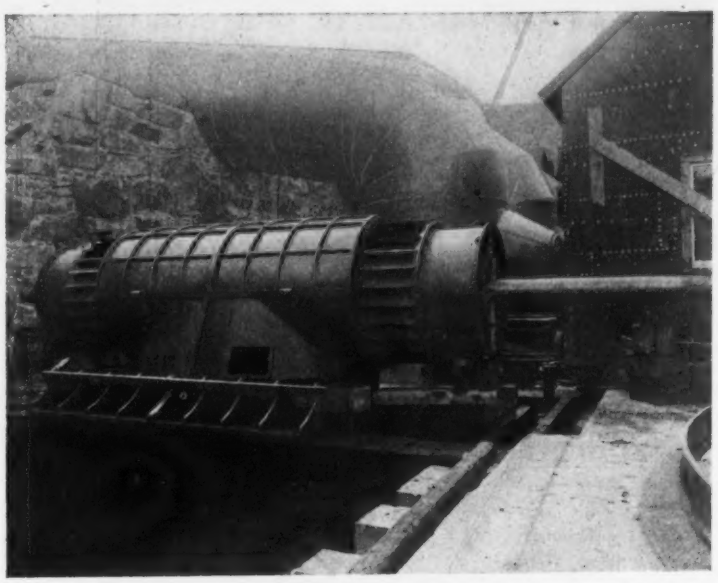


FIG. 13.—ONE OF THE WATER WHEELS.

where lines operating at 26,500 volts from Spier Falls and lines with a pressure of 10,800 volts from Mechanicsville converge. All of the other sub-stations for railway and lighting work in the vicinity of Albany and Troy are fed through the Watervliet sub-station at about 10,800 volts pressure. In addition to provision for a local service at 2,300 volts, the Watervliet sub-station must, therefore, provide for supply to either of these connected sub-stations from either of the lines from the Spier Falls and Mechanicville generating plants. To accomplish this result a single pair of bus-bars is provided at Watervliet, and each bus-bar of the pair is divided by knife switches into as many sections as there are individual wires in the several transmission lines that enter this sub-station from the water power plants. Each wire of the 10,800-volt circuits from Mechanicville, after passing through an oil switch, may be connected to a section of either one of the two bus-bars by means of a double-blade knife switch. Each wire of the 26,500-volt circuits

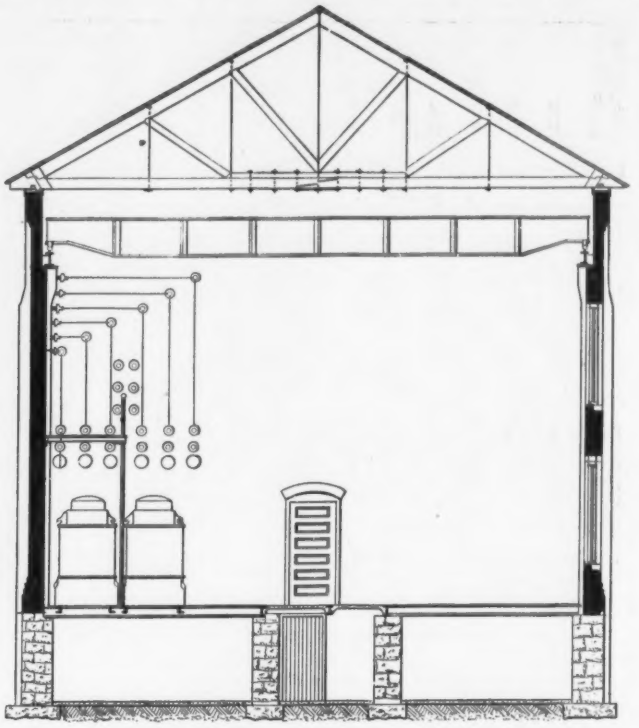


FIG. 15.—CROSS-SECTION OF SARATOGA SUB-STATION.

from Spier Falls, after passing through an oil switch, may be connected by a knife switch with the primary winding of a transformer designed to reduce the pressure from 26,500 to 10,800 volts. The secondary coil of each of these transformers may be connected to a section of either one of the two bus-bars by a double-blade knife switch. A similar switch connects each section of either bus-bar with an oil switch that is in turn connected to one of the wires of a 10,800-volt circuit that runs to one of the other sub-stations at Albany or Troy. Another set of knife switches can be used to connect any wire from Spier Falls with either of two transformers that normally have their primary coils connected to other wires. Besides

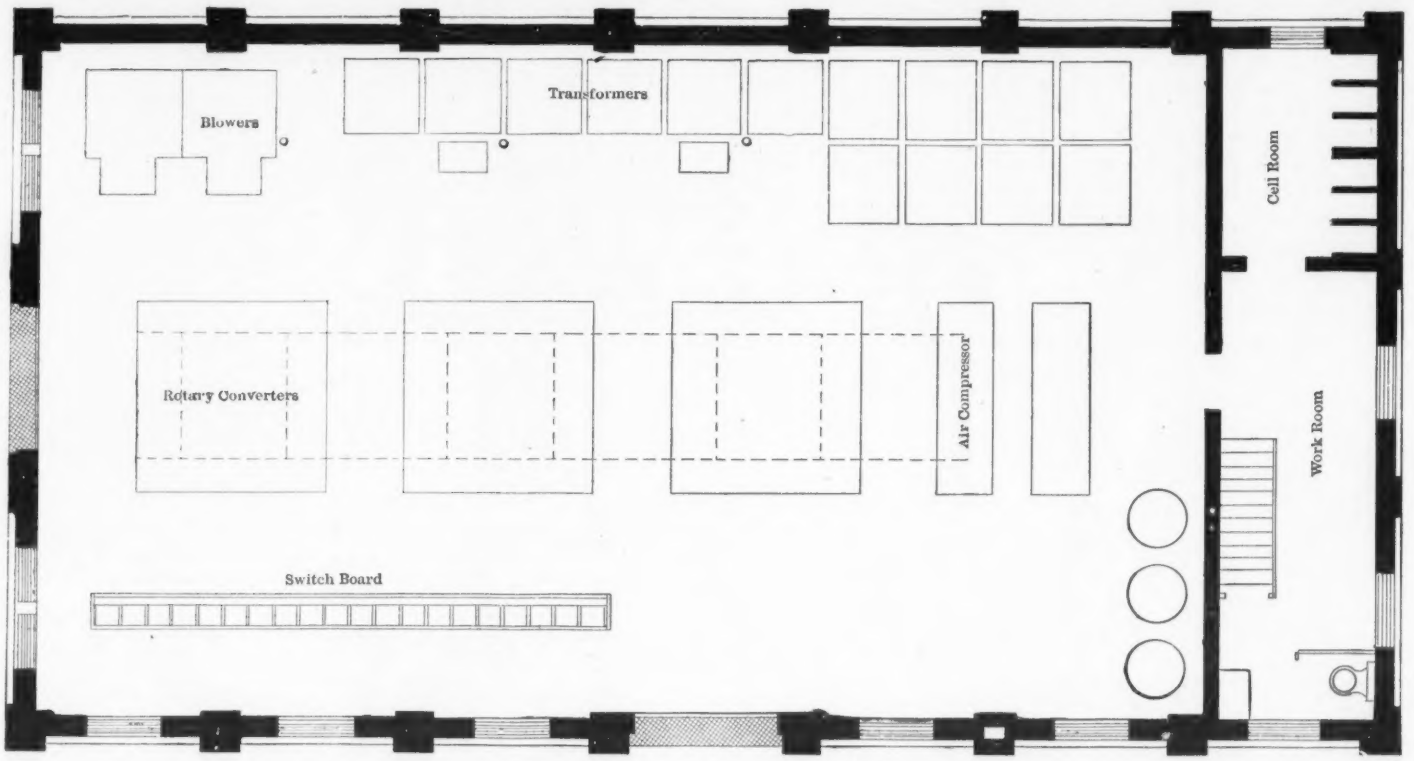


FIG. 14.—FIRST FLOOR PLAN SARATOGA SUB-STATION.

the switches already mentioned for cutting the two 10,800-volt bus-bars into sections, these bars are further cut into two groups of sections by a double-pole oil switch with a knife switch on each side of each pole. To one of these two groups come all the wires from Spier Falls, and to the other group come all the wires from the Mechanicville plant. By means of these two sectionalized bus-bars and the various switches mentioned, any single wire from either of the two water power plants may be connected to any wire running from the Watervliet sub-station to either of the sub-stations which it supplies, either directly or through one of the step-down transformers.

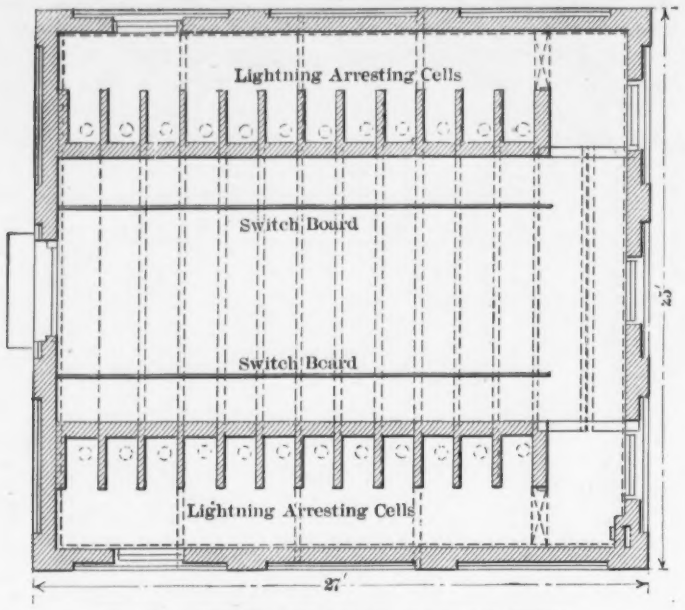


FIG. 16.—GROUND FLOOR PLAN OF SWITCH HOUSE.

At the Albany sub-station, whence the motor generators and transformers of the Albany Electric Illuminating Company are fed, the arrangement of knife switches, oil switches and bus-bars permits either of the three 10,800-volt, three-phase circuits from the Watervliet sub-station to supply either of three 10,800-volt circuits for synchronous motors, through either of two automatic voltage regulators. Furthermore, either of the 10,800-volt incoming power circuits may be connected to the primary coils of transformers that reduce the pressure to 2,300 volts for distribution feeders.

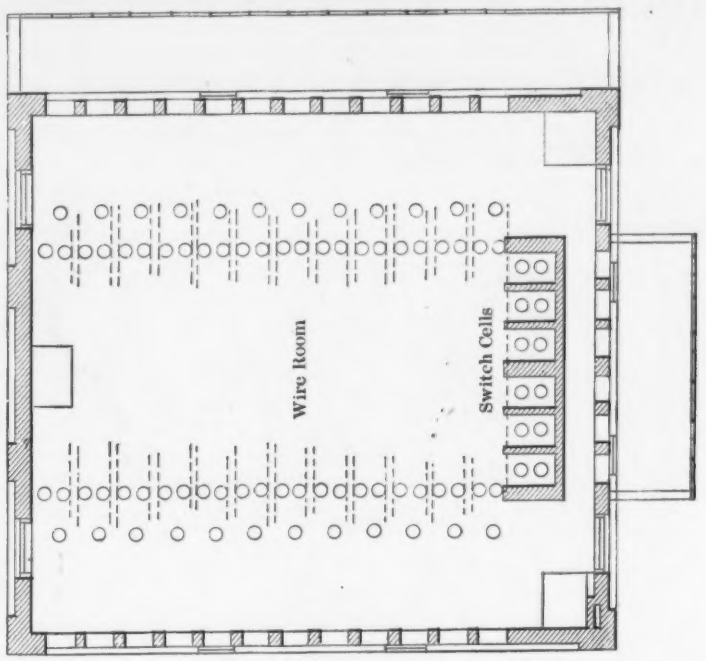


FIG. 18.—SECOND FLOOR PLAN OF SWITCH HOUSE.

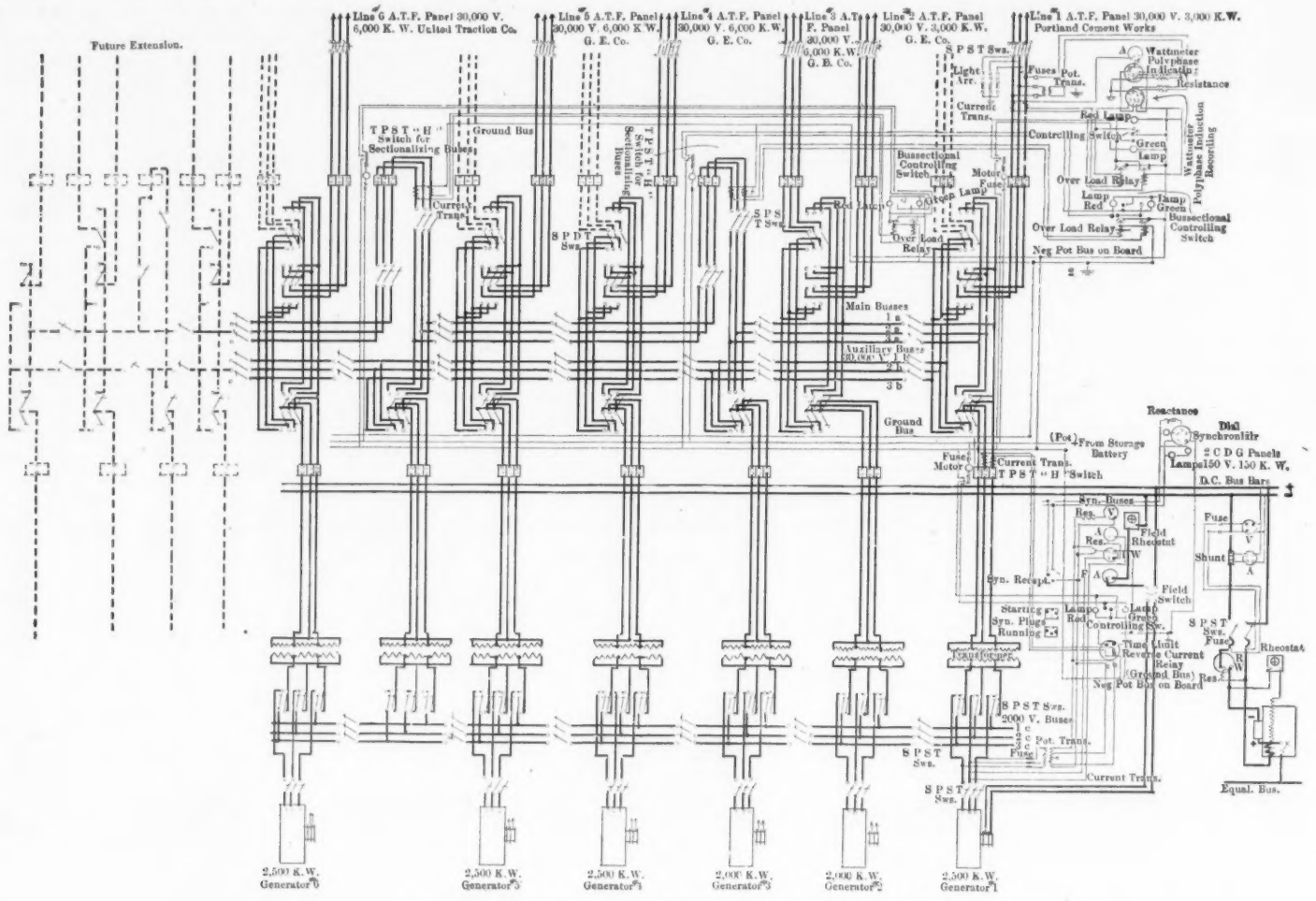


FIG. 17.—SWITCHBOARD CONNECTIONS SPIER FALLS.

The details of connections between the 26,500-volt transmission circuits and the 2,300-volt distribution circuits at the several sub-stations are illustrated by those at Glens Falls. At that sub-station the three wires of a transmission circuit, after entering double-

blade knife switches that connect them at once with lightning arresters and oil switches, terminate in the three 26,500-volt bus-bars. To these bus-bars are connected the current and potential transformers that supply the ammeter, voltmeter and recording wattmeter with its overload relay and tripping coil.

The primary coils of each of three transformers may be connected with these 26,500-volt bus-bars through single-pole, double-throw knife switches. The secondary coils of these same transformers may be connected through similar switches to the 2,300-

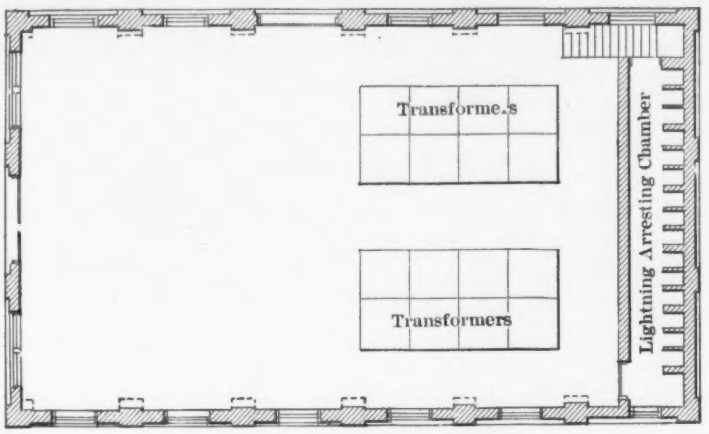


FIG. 19.—FLOOR PLAN OF SUB-STATION.

volt bus-bars that supply the distribution circuits. A fourth transformer has its primary coil connected to one terminal of each of the six double-throw switches that are normally used to join the 26,500-volt bus-bars with the primary coils of the three transformers just named. In a similar way the secondary coil of this fourth transformer is permanently connected to one terminal of each of the six double-throw switches normally used to join the secondary coils of the three transformers with the 2,300-volt bus-bars. These several connections make it possible by throwing four of the single-pole switches to completely disconnect either of the three transformers first named from the 26,500-volt and the 2,300-volt bus-bars,

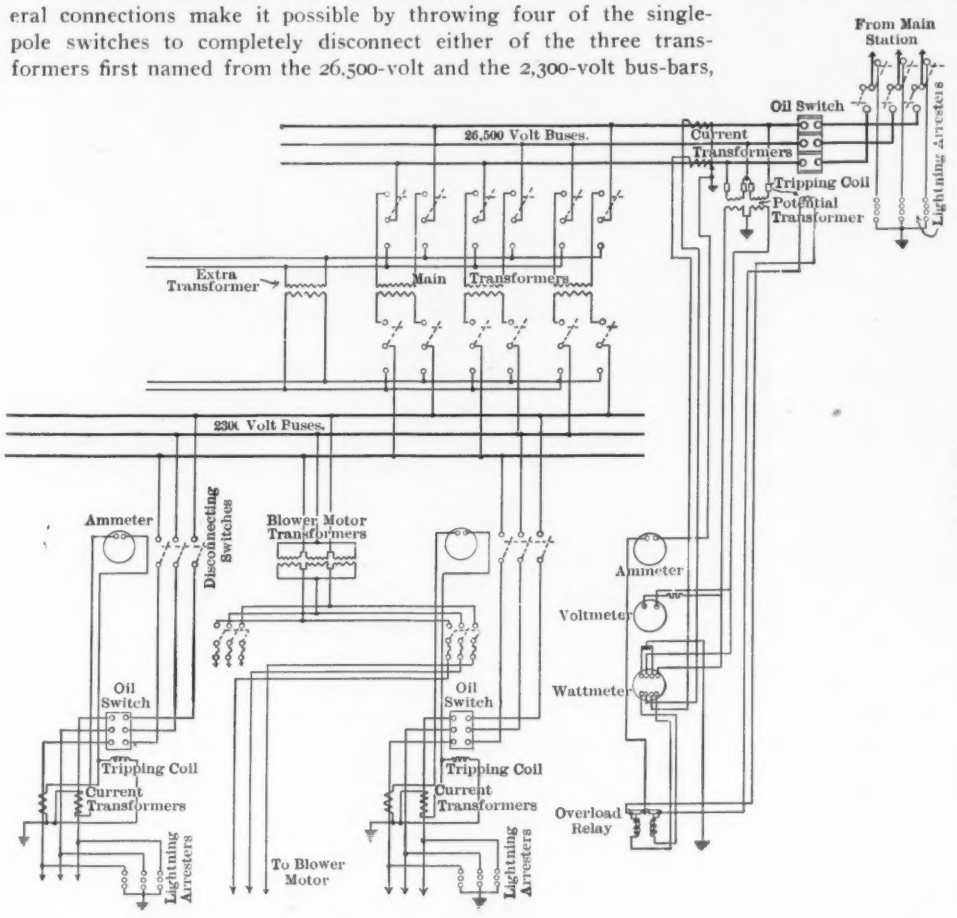


FIG. 20.—SWITCHBOARD WIRING GLENS FALLS SUB-STATION.

and to connect the fourth transformer in the place of the one thus disconnected.

The switch houses at Saratoga, Alplaus and Schenectady correspond in general features of construction, though differing as to size and the number of connected circuits. In each case the walls of the switch houses are brick, the main floor concrete without a basement underneath, and the second floor is made up of concrete and expanded metal resting on steel I beams. Above the second story

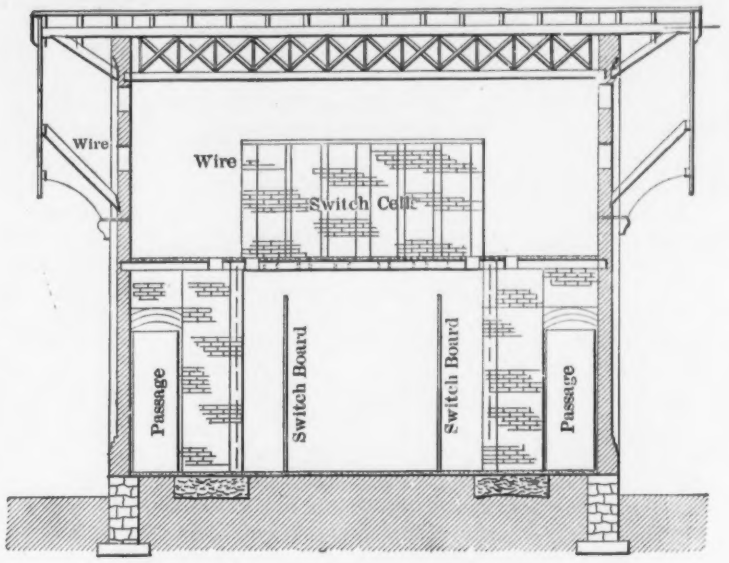


FIG. 21.—CROSS-SECTION OF SWITCH HOUSE.

of each house comes the slate roof supported by planks secured to timber trusses.

The sub-stations built by the company at Glens Falls, Fort Edward, Saratoga, Ballston Spa and Watervliet, though differing in details, follow the same general type of construction, of which the Saratoga sub-station may be taken as an example. This last-named sub-station has an outside ground area of 72 ft. 10 in. x 39 ft. 2 in., and is two stories high, with a distance of 30 ft. from the ground line to the eaves of the slanting roof, and 42 ft. to the ridge. The walls of the sub-station are brick and the roof is slate laid on 2-in. matched spruce planks supported by timber trusses. Underneath the entire building is a basement with a cement floor 6.5 ft. below the first or main floor. From first floor to the lower chords of the roof trusses measures 28 ft. Stone foundation walls of the sub-station are 2 ft. thick, and extend all around the outside to a distance of 18 in. above the ground level. There are also three interior foundation walls each 20 in. thick. Starting from the top of the

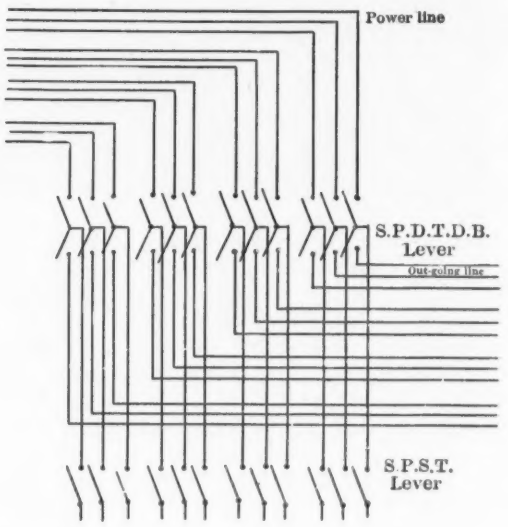


FIG. 22.—SUB-STATION TRANSFER SWITCHES.

foundation the outside brick walls of the station shrink to a thickness of 1 ft. after a rise of a few inches. On the longer sides of the station and spaced at intervals of 8 ft. are piers in the brick wall that increase its thickness to 25 in. At a distance of 22 ft. 7 in. above

the main floor seven of the piers on each of the two longer walls are reduced in thickness so as to form ledges on which rests an I beam for the traveling crane. By means of the interior foundation walls and double doors connecting them a large part of the basement is formed into a compressed air chamber. Into this chamber air is forced by motor-driven blowers on the first floor, and over openings in the floor the air-blast transformers are set. This first floor is of concrete with expanded metal supported in part on 6-in. and in part on 9-in. I beams, according to the weight to be carried. An 8-in. brick partition divides the first floor of the sub-station into a greater and a lesser part, the former being 35 ft. x 61 ft. 1 in. Another 8-in. brick partition cuts the lesser portion of the first floor into two parts, one of which is used as a work room, and the other, measuring 8 x 11 ft., forms the cell room for the knife and oil switches and lightning arresters on the 26,500-volt lines. This cell room extends up through two stories, has a second floor and the high-voltage lines enter its upper part. Along that side of the main floor of the sub-station which is next to the cell room a row of transformers is placed, and the 26,500-volt lines, after leaving the cell room, pass to these transformers over porcelain insulators mounted on the surface of the wall above them. To give ready access to the knife switches that connect these lines with the primary coils of the transformers a gallery 48 ft. 6 in. long and 5 ft. 5 in. wide is erected on the side wall where they are located, and at a distance of 11 ft. 4 in. above the first floor. On the opposite side of the main room of the sub-station from that where the transformers are located is the switchboard with its back 4 ft. 7 in. from the wall. In the center of this main room are spaces for three rotary converters and two air compressors. The two motor-driven blowers occupy a position in line with the row of transformers.

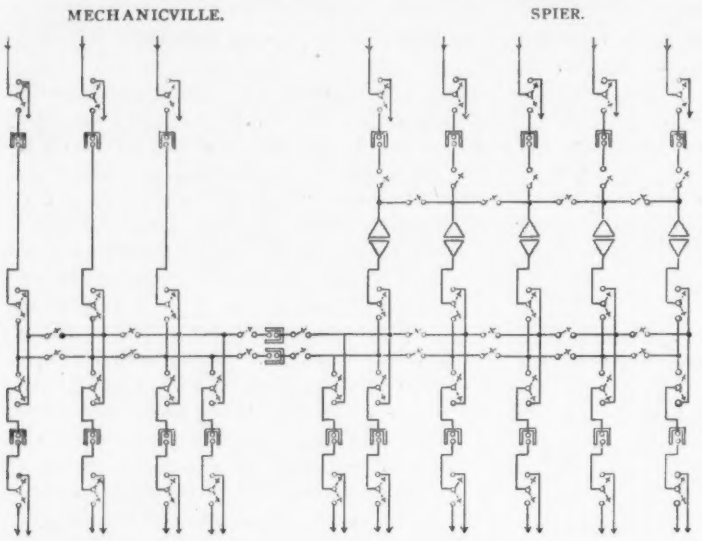


FIG. 23.—MAIN CONNECTIONS WATERVLIET SUB-STATION.

The Glens Falls sub-station is devoted to the operation of lamps and stationary motors in that city, where the Hudson River Water Power Company own the local electrical supply system. Of the four 500-kw transformers at this sub-station, three are regularly used to receive the 26,500-volt, 40-cycle, three-phase current and to deliver it to the 2,300-volt bus-bars. The fourth transformer of like capacity with the others is a spare. The 2,300-volt current is distributed for arc and incandescent lighting and induction motors. Enclosed 500-watt arc lamps for interior use have been operated during some months with the 40-cycle alternating current, and have given good results. At the works of the Glens Falls Portland Cement Company induction motors with a total capacity of 1,000 hp are to be supplied from this sub-station. The load of smaller motors scattered about the city amounts to about 300 hp.

At Saratoga, where the local electrical supply system is also in the hands of the water power company, the sub-station contains four of the 500-kw transformers like those at Glens Falls. Here again 2,300-volt, 40-cycle, three-phase current is supplied for arc and incandescent lighting and induction motors. The series arc street lamps at Saratoga will be operated with constant-current transformers. Included in the load of 350 hp of induction motors operated from the sub-station at Saratoga are three of 20 hp each on vertical shafts in the new sewerage pumping station of that city. Each of these motors is rated to pump 1,150 gallons of sewerage per minute, and all three are controlled by automatic regulators, so that they start and stop according to the requirements of the sewer system.

In Ballston Spa, where the local electrical supply system is also in the hands of the water power company, the sub-station, when completed, will contain three transformers like those at Glens Falls and Saratoga. This Ballston sub-station will be occupied in part by the transformers and converters of the Schenectady Street Railway, which uses some of the power sold to the General Electric Company.

Much the largest sub-station of the water power company is that at Watervliet, which will contain nine transformers of 1,000-kw capacity each. Here the 26,500-volt current from Spier Falls will be reduced in pressure to 10,800 volts and then transmitted, along with the 10,800-volt current from the Mechanicsville plant, to sub-stations of the local electrical supply systems in Lansingburg, Troy and Albany, also to sub-stations of the United Traction Company. The Watervliet sub-station is partly erected, some of its apparatus is already in regular operation, and it is supplying power to the sub-stations of the traction company. By the first of the coming year it is expected that the local electrical supply systems in Troy and Albany will be drawing energy from the same source.

All of the electrical apparatus at the stations and sub-stations of the above transmission system was built by the General Electric Company.

Description of this notable application of water power to electrical supply has been obtained through the kind co-operation of Mr. C. E. Parsons, chief engineer of the work at Spier Falls, and of Mr. J. D. Hilliard, Jr., manager of the electrical construction department of the system.

Meeting of American Society of Municipal Improvements.

The tenth annual convention of the American Society of Municipal Improvements was held in Indianapolis, Ind., October 20, 21 and 22. There were 59 delegates from all parts of the country. Mr. Charles H. Rust, of Toronto, Canada, president of the association, presided at the various sessions. Among the social features was a banquet tendered to the members by the Commercial Club.

The object of the society is to deal with the more technical questions of engineering work connected with the maintenance of the modern city. The membership of the society represents more than 100 cities, besides including manufacturers, contractors, engineers and city officials.

In his address President Rust touched upon the subject of electric railways in and between cities. Owing largely to the methods of construction and the low cost of the right of way, he stated, interurban companies have been enabled to charge lower rates than those charged by steam railway companies, with the resultant effect of causing the steam roads to discontinue local trains in many instances. He referred to modern methods of railway construction, and pointed out the experiences resulting from electrolytic action on underground pipes by the return currents from railway circuits. He was of the opinion that all municipalities should now insist upon trolley and feed wires being placed underground. Mr. Rust thinks that every city should own and operate its water and lighting systems.

Among the papers read was one by Mr. Thomas B. McMath, chief engineer of the Indianapolis Traction & Terminal Company, which was largely a description of the plans of the new terminal station now being erected at a cost of $1,500,000.

Mr. A. F. Hatch, of Detroit, read a paper on the subject of electric lighting in Detroit. He described a card system designed to keep a record of all wires above and underground in Detroit. Mr. Hatch was of the opinion that every municipality would save a good deal of money if the same system were adopted.

A paper was read by Mr. E. A. Fisher, city engineer of Rochester, N. Y., an abstract of which was published in our last issue. Other subjects discussed at the meeting related to water supply, pavements, the smoke nuisance, taxation, etc.

The following-named officers were elected for the ensuing year: President, G. M. Ballard, of Newark, N. J.; vice-presidents, A. P. Allwell, of Easton, Pa., and C. A. Brown, of Indianapolis, Ind.; secretary, G. W. Tillson, of Brooklyn, N. Y., and treasurer, F. J. O'Brien, of Oswego, N. Y. The next convention will be held in St. Louis in 1904.

Dublin Three-Phase Central Station.

ON several occasions, and editorially last week, we have referred to the Dublin electric lighting system, which went into operation in September, and which employs the four-wire, three-phase distributing system. This plant displaces a single-phase installation which was started by the municipality in 1892, and at the time of its displacement had connected the equivalent of 16,500 16-cp lamps. The old plant had a primary voltage of 2,000 with a secondary pressure of 100 volts, and operated with 83 cycles per second. In addition, some street lighting was provided by arc machines. The distribution has been underground from the beginning. The first cables that were laid decayed rapidly and in 1899 an entirely new system was laid, the secondary pressure changed from 100 to 200 volts, and instead of each house having its transformer, all transformers were grouped into five sub-stations. The system, as operated, never gained favor, and it was finally decided to put in an entirely new plant, though $400,000 had been expended on the old one.

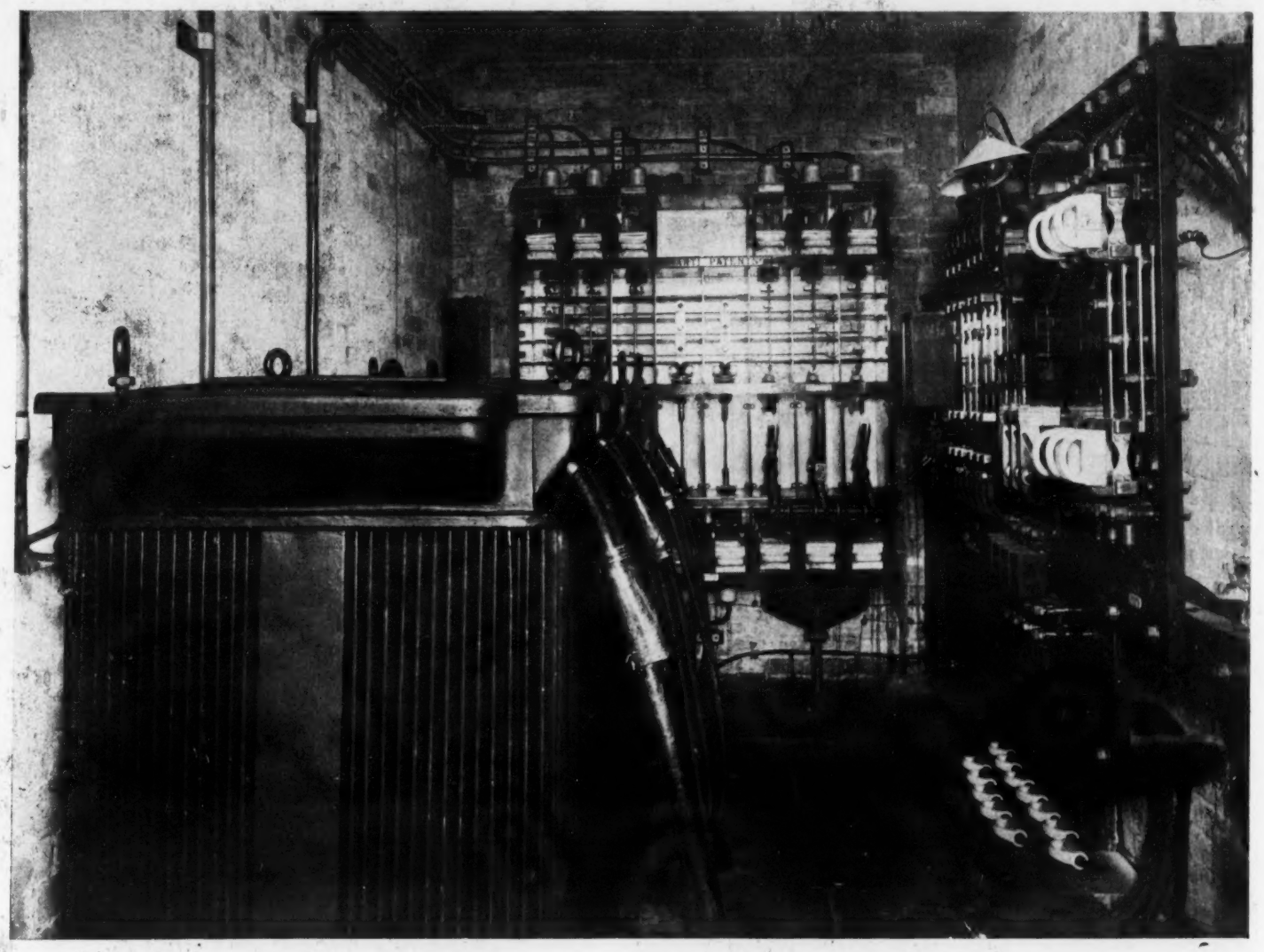


FIG. 1.—VIEW OF INTERIOR OF ONE OF THE SUB-STATIONS.

The cost of the new plant has been $1,222,000, the principal items being, in round figures, as follows: Buildings, $150,000; cables, $545,000; dynamos and engines, $165,000; boiler equipment, $89,000; arc lamps and pillars, $60,000; transformers and meters, $55,000; switchboards, $50,000.

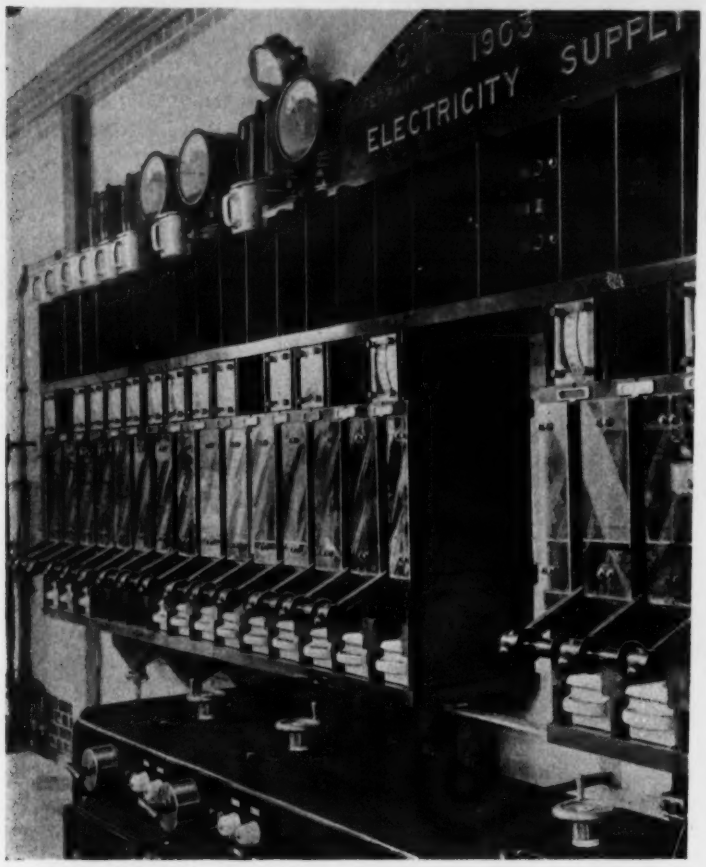
As above stated, the system adopted is a four-wire, three-phase system. Primary current is generated at the entrance of Dublin Harbor and transmitted to a sub-station in the city. The secondaries of the sub-station transformers are star-connected, the old 2,000-volt mains being connected on separate phases between the outer points and center point. Twenty new sub-stations are being added, which will supply 200-volt networks, the lamps being connected between the outers of the star and the neutral common return to the center of the star. The arcs are supplied with direct current through motor-generators.

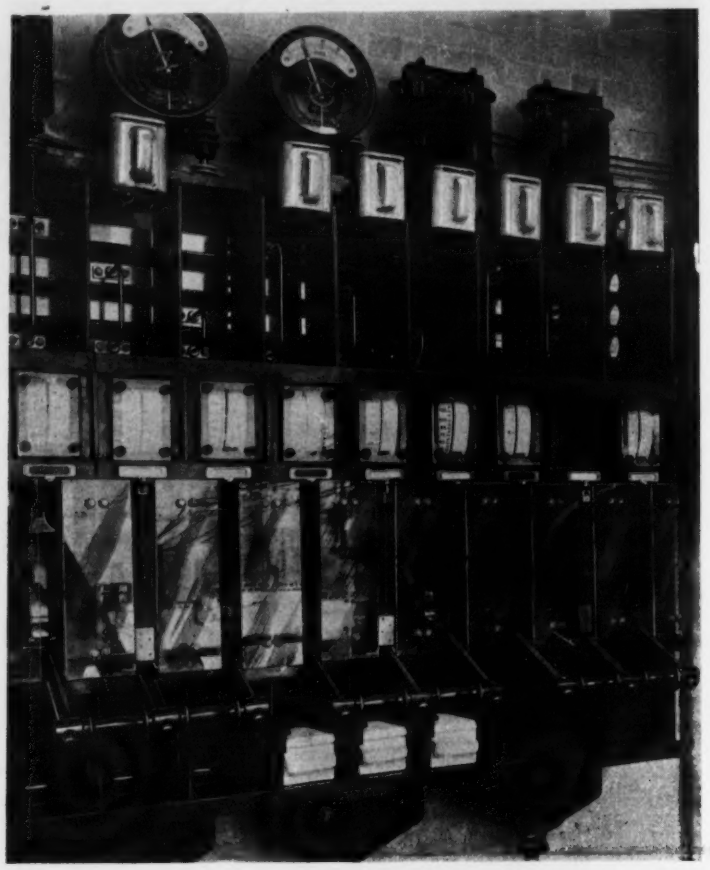
The generating works are equipped with all modern improvements, including coal-conveying apparatus, ash-handling plant, cranes, etc. The main generating sets are four in number, two of 1,000 kw and two of 500-kw capacity, and were supplied by the Oerlikon Works. One of the larger type is shown in Fig. 4, and one of the smaller type in Fig. 5. The magnet coils are wound with bare copper on edge, and the armature coils are accessible on removing two of the magnet coils. The armature casting is in four parts. The windings of the three phases are not connected on the machine itself, but are brought to the terminal box at the side of the frame, and thence three separate concentric cables run to the switchboard, the star connection of the machine being made at the switchboard, as will be explained further on. Current is generated directly at 5,000 volts, the frequency being 50 periods per second. Multipolar exciters, supplying a maximum current of 260 and 320 amp., respectively, at 100 volts, are driven by the main engine shaft, the armatures being overhung.

The normal speed of the smaller engines is 94 r.p.m., with a working steam pressure of 150 pounds per square inch and a vacuum of 26 inches, the indicated horse-power of each engine being 820. The larger engines run at 83.5 r.p.m., and under the same steam pressure and vacuum give an indicated horse-power of 1,620. The guaranteed steam consumption is 19 pounds per kw-hour for the larger sets and 21 pounds for the smaller sets. In addition to the main generating sets there is a 25-kw Kolben motor-generator, which charges a storage battery used for lighting the works. The motor is a squirrel-cage induction motor, which is usually started up from the direct-current side. The station is lighted at 100 volts, so that in the case of an accident to any exciter the alternators can be excited from the storage battery. At a normal six-hour discharge rate the capacity of the battery is 1,200 amp.-hours, and the maximum discharge rate is 650 amp.

The main switchboard (Figs. 2 and 3) is of the Ferranti cellular

type, but there are some slight departures from usual practice in its arrangement. As has already been noted, three concentric cables are brought from each dynamo to the switchboard, these being connected to the three windings of the armature. Each outer of the concentric cables is connected to a bar at the bottom of the switchboard, and this connection is led to a small board upon the same platform as is the main board. Here this connection, which forms the center of the star connection of the dynamo, is earthed through a cut-out and an ammeter, the circuit to earth being broken by the cut-out if the current passing through it exceeds 7.5 amp. On this same board are three ammeters connected between the ends of the bound wires of the iron troughs containing the three feeder cables and earth. The ammeters are worked through transformers, and have each two scales with a different transformer for each. One scale reads from 0 to 3 amp., the other from 0 to 80, and there is a switch above each ammeter to connect up the transformer corre-





FIGS. 2 AND 3.—MAIN SWITCHBOARD.

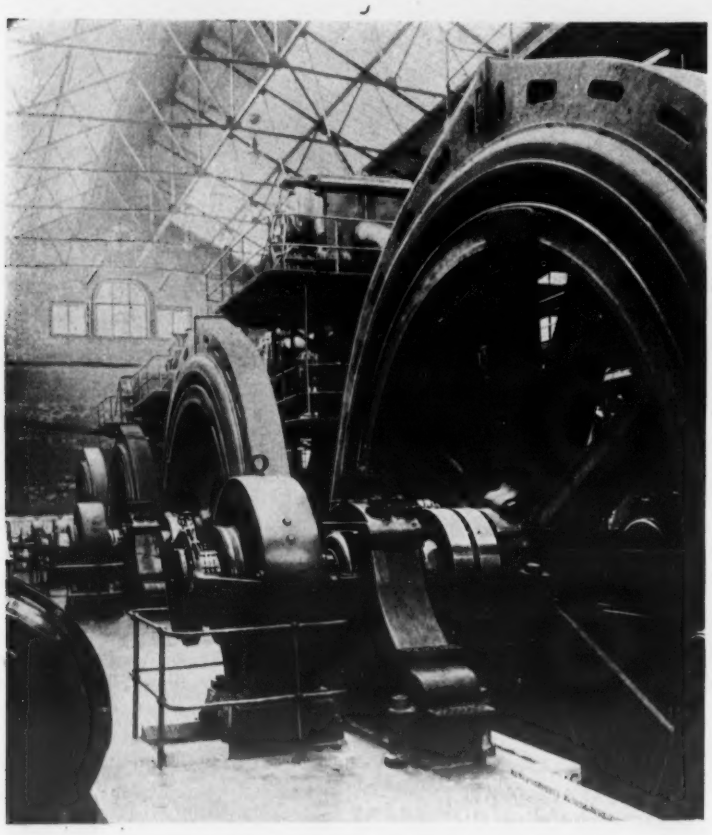


FIG. 4.—1,000-KW UNIT.

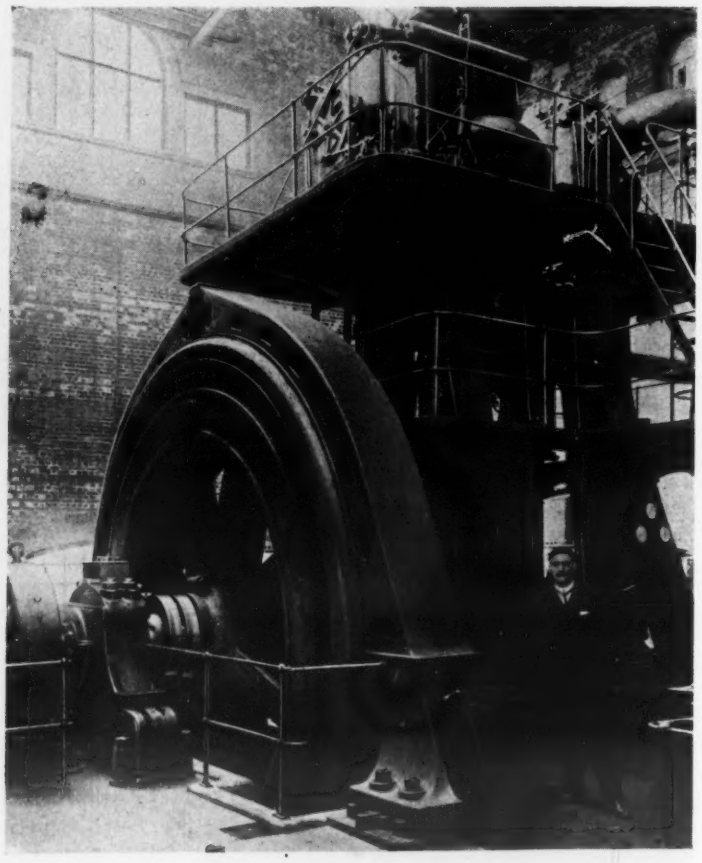
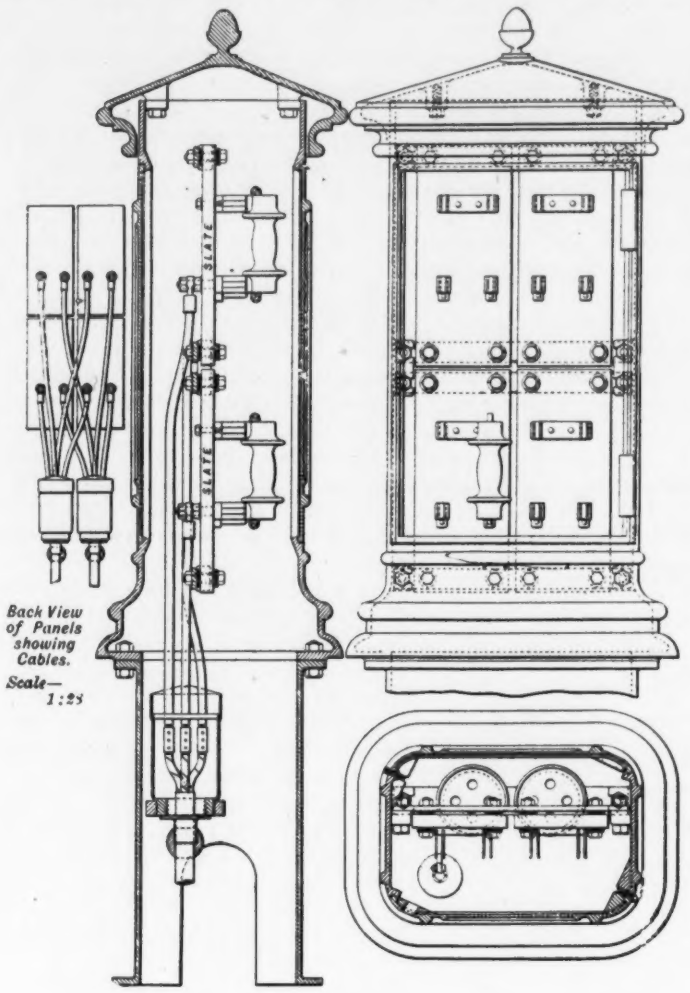
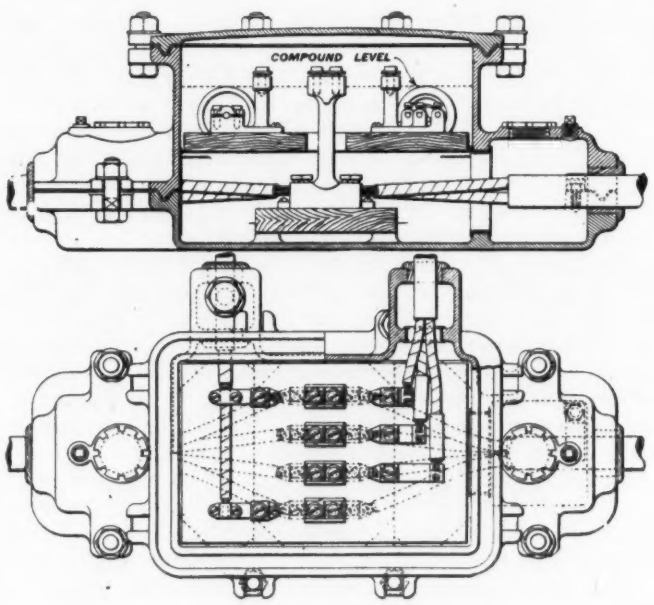


FIG. 5.—500-KW UNIT.

sponding to the range desired. Four integrating wattmeters for the four generators are also placed on this smaller board.



FIGS. 6, 7 AND 8.—SECTIONAL ELEVATIONS AND PLAN OF DISTRIBUTION PILLAR.

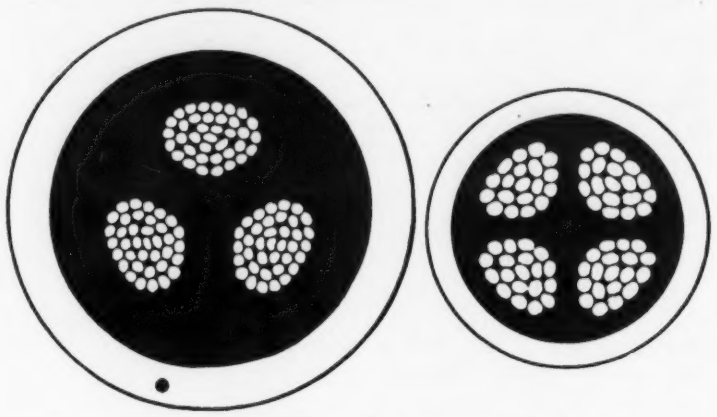


FIGS. 9 AND 10.—ELEVATION AND PLAN OF HOUSE SERVICE BOX.

On the main board the switches are of the oil-break type, shown in Figs. 13 and 14, which give a front view and a section through the working parts of the switch. There are the usual two contacts, the main one at *A*, and the final break at *B* under oil. The contact piece of the latter is a U-shaped steel forging, and the quick release is attained by a spring and trip device, as seen in the drawing, from which also the general construction and relative position of the parts is apparent. The levers of the switches for the three phases, in the case of the generator and of the feeder panels, are coupled together, and the working parts are protected by sheets of glass, as seen in the views of the board. There are three feeders from the generating station to Dublin, two of which are in constant use and one is held as spare. The panels for these are arranged similarly to the generator panels, with the difference, however, that the spare feeder panels are duplicated, one being placed on either half of the board. There is no device either for charging or discharging the cables before switching on or off, and no spark arresters have been fitted to take any possible momentary excess of pressure; the feeders are switched directly on and off the bus-bars. The synchronizing and also the field regulating arrangements are the usual ones, extra switches on the exciter regulating desk being for working signals to the engineman for increasing or decreasing speed.

In addition to the main board and the earthing board already mentioned, there is a small board at one end of the switch platform for the works lighting circuits, the motor-generator and cells, already mentioned. The motors for the coal conveyor and economizer are three-phase, being supplied through 5,000: 100-volt step-down transformers.

Fig. 11 is a full-size section of the main high-tension feeders. Each core of these has a sectional area of 0.15 sq. in., and a capacity of 0.3 microfarad per mile when measured with the other two cores connected to the lead sheathing and earthed. As the feeders are



FIGS. 11 AND 12.—SECTIONS OF HIGH-PRESSURE 3-CORE AND LOW-PRESSURE 4-CORE CABLES.

3.13 miles in length, it is seen that the capacity approaches to 1 microfarad. There being a potential difference of 5,000 volts between the phases, the potential of each of the cores with regard to earth is 2,886 volts. The cables are laid in cast-iron troughing ⅜ in. thick, the troughing being filled up "solid" with pitch in the usual manner. Part of the cable line is under the footway and part under the roadway, and in the latter case an extra protection of concrete is provided. Particular care is taken to have the troughing electrically continuous. There are bosses cast on to the sections of the troughing, and these are faced and thoroughly cleaned immediately before laying the troughs being bolted together as soon as in position. In addition to this, a bare copper wire is run inside the troughing and clamped to each section of it, this wire being also connected to the lead of the cable every 200 yards.

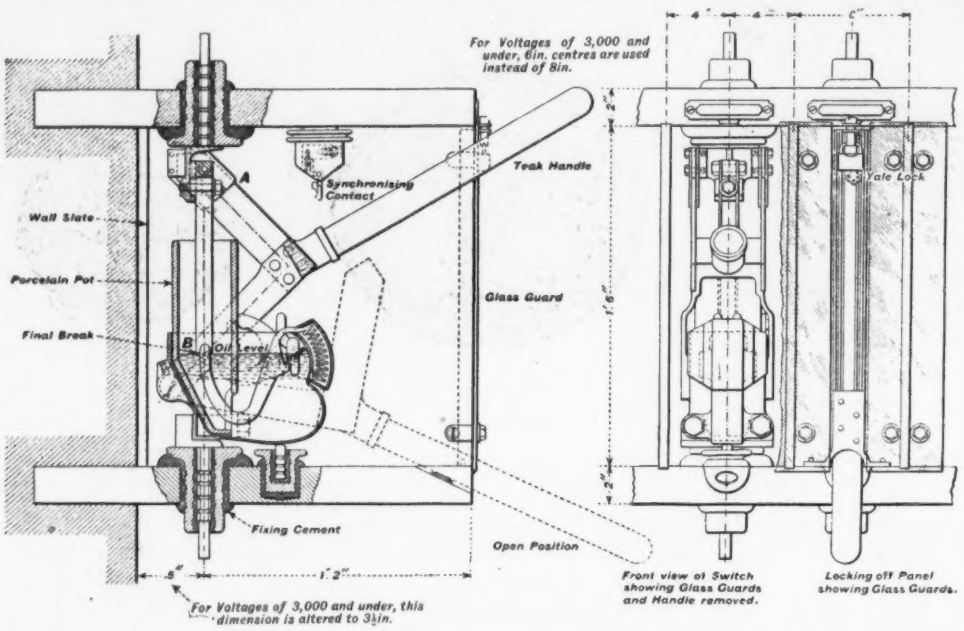
These three cables terminate at the old Fleet Street station, which now forms a sub-station and switching center as well as a depot for testing the regulating mechanism for the arc lamps. On the way they have to cross a canal through a tunnel beneath the bed of the canal. At Fleet Street a large Ferranti board has been erected in two halves back to back. One of the feeders is brought to each side of this board, and the spare feeder has a panel on each board, as is the case at the generating station. At the front of the board are also similar panels for the arc lighting motor-generators, which are erected at the Fleet Street works; the primaries of the step-down transformers have panels at the back of the board, and the extra high-tension feeders to the new sub-stations are divided between the front and back. As the transformers are at the back, and the motor-generators at the front, this is the most convenient arrangement.

The Kolben motor-generators are three in number and are identical, each consisting of an induction motor driving two continuous-current generators. The motor stands in the middle of the bedplate, with a generator coupled on either side of it, and is directly con-

nected to the 5,000-volt mains through the switchboard just mentioned, no transformers being used. It is fitted with slip rings and the standard type of starter, there being a device attached for short-circuiting the rings and lifting off the brushes when the machine has run up to speed. The full-load speed is 488 r.p.m., the machine having 12 poles, and working off the 50-cycle circuit. The generators are employed for arc lighting only, each of these being capable of giving an output of 125 amp. at 550 volts; the set is, therefore, rated at 140 kw. The complete sets have been designed to have a guaranteed efficiency of 84 per cent. at full load. The two direct-current machines of each set are connected in series, the idea being to earth the middle point.

The switchboard for the direct-current side is separate, and is arranged to deal with the three double dynamos and with feeders for the arc circuits. In working, the circuits are divided into two groups, which are fed by separate dynamos, and the third set is held in reserve as a spare. There is also a switchboard at which the actual arc lamp circuits can be subdivided. In all there will be 23 10-amp. circuits with from 19 to 22 lamps on each.

The old lighting system was single phase, current being supplied at 2,000 volts from the Fleet Street sub-station to five sub-stations, from which low-tension, single-phase networks were fed at 200 volts. These sub-stations and networks are retained, and are, in fact, still fed from the old switchboard at Fleet Street, the step-down transformers already referred to being employed to change the pressure from 5,000 to 2,000 volts between the two switchboards.


For Voltages of 3,000 and under, 6in. centres are used instead of 8in.
Teak Handle
Synchronising Contact
Wall Slate
Porcelain Pot
Final Break
Glass Guard
Oil Level
Fixing Cement
Open Position
5"
1' 2"
For Voltages of 3,000 and under, this dimension is altered to 3½in.
Yale Lock
Front view of Switch showing Glass Guards and Handle removed.
Locking off Panel showing Glass Guards.

FIGS. 13 AND 14.—SECTION AND ELEVATION OF OIL-BREAK SWITCH.

For this purpose three 250-kw, single-phase Westinghouse transformers have been provided, with a fourth one as spare, and also four 50-kw transformers (one being spare) for the light-load periods of the day. The primaries of the transformers are delta-connected, and the secondaries star-connected, the middle of the star being earthed. The secondary terminals of the transformers are directly connected to the old high-tension board, so that each group of three takes three independent circuits. Any motors on these circuits must be single-phase, but few are connected at present, and the new motors which come on will doubtless all be connected to the new three-phase secondary networks.

The new three-phase circuits are fed from 20 overground sub-stations, one of which is shown in Fig. 1. Here the current is transformed down to 200 volts, the primaries of the transformers being mesh-connected and the secondaries star-connected, 200 volts being the pressure between the outers of the star and the center point. The secondary networks are all distinct and not interconnected, and four-core cables of various sections are employed for distribution. One of these is shown in section in Fig. 12. The lamps are placed between one of the conductors connected to the outer of the star and the fourth conductor, which acts as a common return for the three phases, and is joined to the center of the star and earthed. Theoretically, of course, if the three circuits were perfectly balanced, no current would flow back through this conductor, but in practice it appears that the circuits will be far out of balance; that the four cores have been given equal section. The motors are, of course, to be connected across the phases without the neutral wire being employed. That the main reason for the adoption of this system is that it allows of a higher pressure between the three conductors corresponding to the three phases than if the lamps were simply connected on the three phases in the ordinary way. Two hundred volts has to be supplied at the lamp terminals, and by this four-wire connection the pressure between the three main conductors is 200 $\sqrt{3} = 346$ volts. Thus, even with four conductors of equal section, the total weight of copper employed is diminished. On the other hand, each conductor has to be better insulated, and, what is more important, the method of connection introduces more complications in the junction boxes and increases their size. Fig. 6 shows a four-core distribution pillar and Figs. 9 and 10 a plan and sectional elevation of one of the house service boxes, these being typical of the designs employed. The box in Fig. 10 shows an ordinary lighting and a motor connection taken off from a four-core distributor. The low-tension cable is laid in the same manner as the high-tension cable, except that when the troughing is under the footways its thickness is reduced to ¼ in. Before handing over, all cables, both high and low-tension, were tested at double the working pressure, and in the total quantity of cable laid (150 miles) only four faults were discovered, two of which were due to mechanical injury.

To encourage new consumers a reduction has been made in the tariffs for electric light and power. Hitherto the charge has been a flat rate of 12 cents per kw-hour, but now the Wright system has been adopted. The charges for lighting are 14 cents for the first hour and 5 cents after, and for power 14 cents for the first hour and 2 cents after. There is now under consideration as an alternative a flat rate of 12 cents for lighting and 6 cents for power, and special flat rates of 9 and 8 cents, respectively, for lighting places of worship and theatres, music halls, etc. Meter rents are charged, the charge being from 67 cents to $1.87 per quarter, according to size.

The Electrical Industries of Germany.

Mr. Simon W. Manauer, Deputy United States Consul-General at Frankfort, reports as follows on the state of electrical development in Germany. The electrical industries of Germany form the subject of a brochure published by Dr. Bürner, the syndic of the Association for Guarding the Interests of German Electrotechnics. This expert says that in the year 1900 about 2,500,000,000 marks ($595,000,000) was invested in that branch of German industry. The severe crisis which it has undergone, and from which it still suffers, is in the main due to the following causes:

1. The electrical companies, instead of confining their activity to manufacturing, engaged in promoting ventures and obtaining concessions, and carried on the building of electric roads, lighting plants, etc., in the towns and rural districts, instead of leaving those enterprises to the municipalities, financial promoters, and private companies.

2. A great mistake was committed in erecting and conducting branch electrical factories in foreign countries, which caused numerous competitors to spring up in those countries and led other German companies to enter the foreign business, thereby producing a sharp struggle to obtain profitable orders.

As a third error, Dr. Bürner names the practice inaugurated by the electrical companies of establishing installation shops in all the cities and large towns of Germany, instead of leaving that part of the business to the resident plumbers and installation concerns.

Dr. Bürner does not favor the plan of uniting the German electrical companies in one common concern. He urges the formation of syndicates to regulate and protect prices and limit production where such is unprofitable. His main recommendation is to extend and increase the export trade.

The Electrical Drive for Machine Tools.

BY ROBERT LOZIER.

THE writer has read with a great deal of interest on page 473 in the September 19th issue of ELECTRICAL WORLD AND ENGINEER, the article written by Mr. C. H. Hines on the electrical drive as applied to machine tools with special reference to railroad shops. Mr. Hines truly indicates that the rapid developments in air hardening steels have been largely responsible for shopmen investigating the methods that are available for increasing the driving speeds of the tools so as to get all the advantages out of these rapidly cutting steels.

Now, in seeking these advantages, the shopman desires to increase, first, the total range of the machine tool speed, and, second, the number of changes that can be made in that larger range.

To apply these new conditions the operator should study the tool or tools and see how far these changed conditions can be applied, and then seek the system that best accomplishes these results, rather than to first select a particular system and then endeavor to make the tools fit its possibilities or limitations. Judging from Mr. Hines' article there is no lack in the number of systems available to select from.

In studying the methods of driving tools Mr. Hines makes two general classifications: First, the new machine shop with a complete outfit of new tools on which the work to be done is of a varied character; and, second, those shops consisting largely of old tools in which the work to be done is practically of the same nature year in and year out.

He states that in his mind there is "no doubt of the superiority of the individual motor with varying speeds," for the first classification he makes, and I agree, in general with him, on that particular point. As regards the second classification—the shop with the old tools—he states it becomes a question of whether it would pay to attach individual motors to old machines (but too serviceable to be scrapped), most of them unfitted for high speed steels, and the inference is that he considers it best to group these old tools and drive them from a common line shaft "providing such speed changes that might be necessary by mechanical means." I would suggest that he should have considered these old tools in which the speed is not to be varied separately from the old tools in which the speed is to be varied. If we consider the old tools in which the speed is to be varied, then we should be careful to determine how far we can benefit by applying the individual motor with its variable speeds to these old tools before we consign them to group driving; for it must be remembered that such an old tool requires just as much expenditure for wages as if it were new, and it is with a view to making the wage produce a greater output, from the tool, that forms the principal reason for adopting the individual motor drive with its wide and flexible speed range.

The reason for Mr. Hines' preference for grouping old tools seems to be found in the latter part of his statement, that "it becomes a question of whether it would pay to attach individual motors to old machines *most of them unfitted for modern high-speed tools.*" (The italics are the writer's.) I gather from this that he has in mind the fact that the old tools are not able to stand the strain of displacing metal at the high cutting speeds that the new air-hardening steels are capable of. Herein lies the meat of the argument, and I desire to particularly point out that the increased output of a tool does not by any means always depend upon displacing all the metal the cutting tool is able to stand, but upon doing any particular piece of work at the most economical speed. If we have but five steps to our cone pulleys with the usual ratio of speed, it is not uncommon to find that we cannot get within twenty per cent. of the speed we desire. With a twelve-step variable speed motor properly proportioned, we can get within seven and one-half per cent. of the desired speed, and these variations are not only more readily obtained but can be made while the tool is cutting by simply moving the controller handle, instead of shifting the belt. Thus the individual variable-speed motor has a material advantage in that it has many more increments of speed, any one of which may be attained with greater ease than with the belt-driven tool. This applies equally to an old tool as to a new, and is quite apart from the further advantage that the range which represents the sum of these increments of the variable-speed motor is greater than the old cone variations, and enables the tool to be run at a higher speed than before, which applies only to such tools as can stand the racket, whether old or new.

I will take Mr. Hines' example of the wheel lathe to illustrate the point I have just endeavored to make. He states it as follows: "Now it would be folly to attach to such a tool a variable-speed motor with its high initial cost simply to provide for an occasional 'hard spot' or an unusual hard pair of tires, for cone pulleys would take care of such rare cases."

If this wheel lathe were equipped with an individual variable speed motor, a tire could be turned at the rate of twenty-six feet per minute if it has no "hard spots." If it had "hard spots"—and they are not infrequent in wheel tires—at each revolution the operator, by means of a multiple-voltage controller, slows the same down to a speed of four feet per minute while passing over a "hard spot," turning at least ninety per cent. of the tire at twenty-six feet per minute and ten per cent. of the tire at four feet per minute. With a belt-driven lathe, it would be necessary to adjust the speed for the entire process to four feet per minute (or for one hundred per cent. of the time) to accommodate the "hard spot." Mr. Hines, under such conditions, will only get out of the belt-driven lathe twenty per cent. of the work that is got out of a motor-driven lathe. This applies equally well to boring mills. The writer has even seen this thing carried out to a very much greater refinement in the case of finishing the outside of a spider in which a motor is speeded up at the space between the spider arms and slowed down just as the tool enters the face of the spider arm.

If we are to retain these old tools we must use every possible method for increasing their output to keep pace with the new, and as we cannot in some cases run as high in speed, we *can* facilitate the work by quickly changing the various speeds. In order to illustrate this statement by what has long ago been done in machine-shop practice, I would point to the engine lathe and turret lathe. The turret lathe was introduced not because it removes metal more rapidly than the engine lathe, but because it can be changed from one operation to another more quickly.

Now, however, if the tools are to be grouped, then it becomes necessary to select the best form of power distribution and type of motor. In making this selection Mr. Hines gives the preference to the induction motor and gives as his only reason for doing so the absence of the commutator; but again it is advisable to consider all the points involved in the systems available, so that in the one selected the advantages outweigh the disadvantages to the greatest extent.

For example, it may be of some slight advantage to have motors without commutators for the constant-speed work, but does this offset the consequent disadvantage of having two complete systems of power circuits and corresponding kinds of motors in the shop—one the alternating polyphase current for the induction motors which have no commutators and which cannot vary the speed, and the other, the direct-current multivoltage system for the variable speed motors? Concerning the latter Mr. Hines says, "It will be necessary perhaps to have a small amount of direct current for cranes and these will be perhaps a few large tools that it may pay to equip with individual variable speed motors." As it is, therefore, necessary to have the direct-current system in order to have variable-speed motors, not only for the cranes and big tools, but also for the new tools for doing work of a varied nature that will be introduced from time to time, why not select the direct-current system solely? It can successfully perform all the classes of shop service—that is, variable speed for tools and cranes, constant speed for tools, group driving and electric lighting. Why complicate this simple plan by adding to it the polyphase alternating-current system for accomplishing a purpose that can be well performed by the direct-current system which must be installed if individual motors are used to drive tools and cranes? Concerning this very alternating-current system, Mr. Hines says in his article, "In deciding upon the size of motors to be provided for the different tools, care must be taken in the case of the induction motor that the question of power factor is considered, as if the motors are much too large for the work they are to do, the station will have a large factor of wattless current to deal with."

Why have these wattless currents and other complications when the manufacturers of direct-current motors are guaranteeing their commutators to have sparkless operation for fifty per cent. overload, and the friction cannot be counted against them because their total efficiency is as high and generally higher than that of the induction motor?

In summing up the very interesting proposition involved in Mr. Hines' article, may I venture to suggest as my view of the case that

it is best first to carefully consider all of the conditions to be met, not only as concerns the tools themselves, but their relation to each other, the disposition of overhead space with reference to crane service, light and heat, character of building with reference to supporting mechanical power transmission, or a lighter construction permissible with individually-driven tools; and then having finally determined all those questions individually and collectively, to select that one system of power transmission which possesses the greatest common good.

We are glad that Mr. Hines will at some future date give us a detailed description of the plant with tests, and are sure that the ideas he sets forth are of value not only as being an expression of his opinion but as opening the way to a full discussion of this most interesting and comprehensive study.

Electrically Operated Mine Pumping Engine in the Gneisenau Mines, Germany.

Last year the management of the Gneisenau mine, near Dortmund, Germany, decided to replace their small lighting plant by a large electric central power station, which was to furnish current for lights and a large number of motors situated in the various shops. At the same time a new mine engine was to be installed which was to be operated by a 665-hp electric motor. As this motor consumed about one-third of the total output of the station, the three-phase current was selected, at a pressure of 2,500 volts and 25 periods per second. In this manner the advantages of the asynchronous induction motors, versus direct-current motors, were utilized. For light and power purposes during the daytime the voltage is transformed to 500 volts, while the pump motor is operated at 2,500 volts. The installation includes the following apparatus: Two direct-connected dynamos, furnishing three-phase current, each of 625-kw capacity; two transformer sets for excitation and lighting, furnishing direct current, one of 38 and the other of 50-kw capacity; one direct-current, direct-connected generator of 38-kw capacity, for the starting excitation of the primary generator; one asynchronous pump motor of 665 hp for operation of the subterranean mine engine. The entire plant was installed by the Helios Elektrizitäts-Aktien Gesellschaft, of Cologne.

The engines were built by the Sächsische Machinenfabrik of Chemnitz. They are of the horizontal compound type, having a

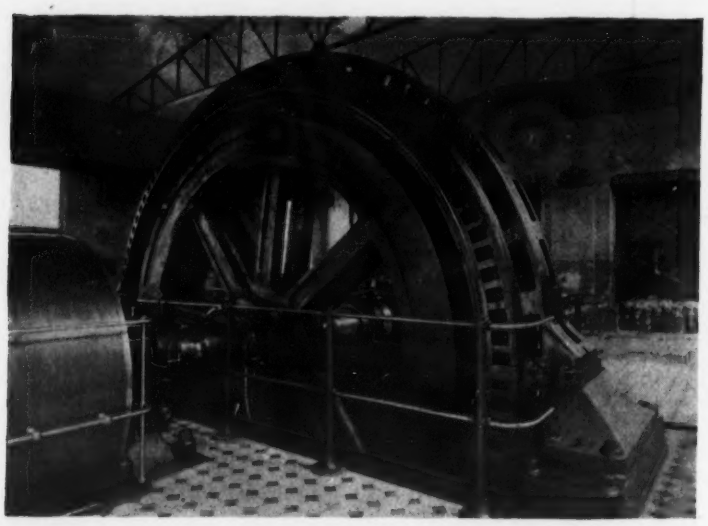


FIG. 1.—ONE OF THE DYNAMOS.

rating of 680 hp at 83 r.p.m. The dynamos are of the internal pole type; that is, the poles are attached to the fly-wheel which forms the rotor, as shown in Fig. 1. The data are as follows: Diameter of magnet frame, 4,760 mm.; axial width, 330 mm.; number of poles, 36; e.m.f., 2,500 volts; number of slots, 423; bars per slot, 3. The cast-iron frame is light but solid, and so constructed that even while the machine is in operation all parts can be inspected and repairs be made with ease. The two generators are excited by two transformer sets, each consisting of a three-phase motor coupled to a direct-current egenerator. For the excitation of the generators after the plant has been shut down, a 38-kw, direct-current dynamo, driven by a steam engine by means of a belt, is used. This method obviates the necessity of a storage battery.

The subterranean mine engine was built by Ehrhardt & Sehmer, of Schleifmühle, near Saarbrücken. It consists of two double-acting plunger pumps with common crank shaft, the cranks being set at 90° apart, and is driven by a direct-connected, three-phase motor. The two pumps have two air suction cylinders, four air pressure cylinders and a common air pressure cylinder for the discharge. The plunger is 216 mm. in diameter and the stroke 600 mm. The pump is located 380 metres below the surface and the suction

FIG. 2.—CONSTRUCTING MOTOR IN PUMP CHAMBER.

height is from 3 to 4.5 metres. The duty of the pump at a speed of 61 r.p.m. is 5.3 cu. metres.

The data of the three-phase asynchronous motor direct-connected to the pump are as follows: External rotor diameter, 3,600 mm.; axial width, 610 mm.; r.p.m., 61; number of slots on rotor, 576; bars per slot, 2; number of slots on stator, 432; wires per slot, 16. The motor may be started by the dynamo direct or from the bus-bars.

Many difficulties were encountered in the installation on account of the small cross-section of the shaft, namely, 1,800 x 800 mm. It was necessary to build the stator in four parts, bolt the feet on separately and wind the stator in the mine. The two-part rotor also had to be wound after it had arrived at the mine. Special care had to be taken in transporting the material through the wet shaft, as well as the winding in the damp pump chamber, shown in Fig. 2.

The armature body and pressure plates, which also support the winding are provided with numerous holes, so that the air can circulate freely and the sheets and winding be kept cool. The stator consists of a four-part cast-iron frame, to which the plates are fastened by means of bolts. On the other end of the armature are the collector rings of phosphor-bronze with a short-circuiting device constructed as follows: On the outside of the collector rings is a flat plate with contacts which are alternately connected to the collector rings. By means of a lever a ring can be brought in touch with these contacts, thus short-circuiting the collector rings. A second lever lifts all the brushes. These levers are interlocking. The two movements can only be executed in succession and in the right order.

The pump motor may be started in either of two ways: Firstly, the short-circuited motor may be connected to one of the two dynamos, which is at rest. As soon as the dynamo begins to turn, the motor also turns and reaches its full speed simultaneously with the dynamo. This is the simpler and more convenient method. It requires no collector rings on the motor, but it is necessary when starting the same to first stop a dynamo. On this account there must be two separate three-phase circuits provided at the switchboard; one for the ordinary light and power service, and the other for starting the pump motor. As it was found desirable, however, to be able also to start the motor directly from the circuit, an oil-cooled starting box was installed, by means of which resistance was inserted into the rotor circuit at starting.

This starting box has stationary brushes through which the current is led, while the contacts from which the current is supplied may be moved by means of a vertical shaft. These contacts are built up like a collector with air insulation. Nickeline strips are used as resistance, and are imbedded in oil. As the brushes are stationary and the resistance moves in oil, a good circulation of the oil is effected. To further cool the oil, a coil of pipe is contained in the box, through which mine water circulates. As the motor is always started without a load, the starting box did not require to be very large. Furthermore, the starter is not used frequently, for the motor, if once started, frequently operates for one or two days or longer without being stopped.

Electrical Supply in Fitchburg, Mass.

Since the article published under the above heading in ELECTRICAL WORLD AND ENGINEER of October 3, 1903, was prepared, the details of the new plant at Fitchburg have been pushed to completion, save that the old boilers are still in use.

Outside of the station the circuits have been arranged so that the series enclosed arc street lamps may be operated from the tub transformers. The old 500-volt, direct-current power circuit has been discontinued over much of its length, and a new 550-volt, three-phase circuit for induction motors has been erected. This power circuit is fed by transformers at the station and one other point, and as these transformers take current at 2,300 volts the plan results in a saving of copper.

The new chimney mentioned in the preceding article has a height of 138 ft. As the new station is located on the bank of the Nashua River, the water of this stream is used for condensing purposes. This water is not sufficiently pure for use in the boilers, however, owing to elements introduced by factories further up the stream, and feed water for the boilers is, therefore, drawn from the public supply pipes. Sheets of ground and pressed cork each 9 x 36 in. in area and ½ in. thick are cemented to the concrete filling over the steel beams to form the cork floor of the generator and engine room. On the traveling crane that sweeps over the entire generator room are two hoists, one being of 20 tons and the other of 5 tons capacity. Both of these hoists are hand-operated. The Reading Crane & Hoist Company are the builders of this crane. In the wire tower named above racks for the lightning arresters are located and the 550-volt, the 2,300-volt, and the 4,000-volt lines pass from the switchboard down to the basement ceiling, then along to and up over these racks to porcelain tubes bedded in one brick wall of the tower. These tubes have a downward slant toward the outside of the wall, and the wires after passing through them are secured to nearby insulators. In this way between 40 and 50 wires leave the wire tower for a nearby pole. Onto each of these wires a lightning arrester is connected, and the other side of each arrester is joined to the grounded copper bar that is located along the under side of its rack. To each wire of the three-phase, 550-volt power circuit a lightning arrester with one carbon resistance rod and one air-gap between brass cylinders is attached. To each wire of a 2,300-volt circuit for commercial arc and incandescent lighting an arrester is connected that has one carbon resistance rod, and two air-gaps between brass cylinders. On the 4,000-volt lines for series arc lighting an arrester with two carbon rods and four air-gaps between the brass cylinders is connected to each wire. Besides the foregoing lines and lightning arresters there are two pressure wires for each 2,300-volt circuit, and to each of these pressure wires an arrester with one carbon resistance rod and one air-gap between brass cylinders is connected.

The switchboard is equipped with one set of 2,300-volt, three-phase bus-bars to which the generators feed and from which all of the lighting and power service in the system is derived. Energy for the series arc lighting is supplied from these 2,300-volt bars through the 4,000-volt tub transformers. For the 550-volt, three-phase power circuit that carries the load of induction motors two transformers are in use, each rated at 75 kw, and reducing the pressure from 2,300 to 550 volts, three-phase, 60 cycles. One of these transformers is located in the basement of the generating station, and the other like transformer is about one mile from the station. With the 550-volt, three-phase motor circuit is connected an induction motor at the power station that drives by belt a 45-kw, 500-volt direct-current generator for the few remaining motors of that type. Each main generator is connected to the three-phase bus-bars through an oil switch, and this is also true for the circuit that supplies the eight tub transformers, the circuit of the power transformers, and the three circuits for general commercial lighting. All of these oil switches are operated by magnets and for each oil switch a small knife switch is carried on the face of the switchboard. By closing one of these small knife switches the magnet winding of its oil switch is charged with direct current from one of the 125-volt exciters, and the resulting pull opens or closes the contacts. All of these oil switches were supplied by S. B. Conduit, Jr., & Co., of Boston. All of the generators, transformers and motors above named were built by the General Electric Company, as were also the volt, ampere and the indicating and recording wattmeters found on the switchboard.

General commercial arc and incandescent lighting in Fitchburg is provided for by three three-phase, 2,300-volt, 60-cycle circuits. Each of these circuits is fed by two sets of three-phase feeders having six wires in all, and from each of these three circuits a pair of pressure wires is run back to the power station. Just at present the only means of pressure regulation employed at the generating station is to vary the voltage on the main bus-bars by changes in the exciting current of the generator magnets. Three automatic regulators for the three commercial lighting circuits are an order, however, and their use will make it possible to supply different voltages to the station ends of the feeders for these three circuits.

The present number of enclosed arc street lamps connected to the tub transformers of the Fitchburg system is 306. The number of commercial enclosed arcs operated from the constant pressure lines is about 86. For incandescent lamps of all sizes the total connected load numbers 12,000 nearly.

For the 48 motors connected to the electrical supply system the total rated horse-power amounts to 302. The greater number and capacity of these motors is on the 550-volt, three-phase, 60-cycle power lines. With the highly efficient generating equipment now installed at the Fitchburg station a large and rapid increase of its motor load is to be expected, as the demand for power there is large.

Electricity in the American Navy.

The annual report of Rear Admiral Bowles, chief of the Bureau of Construction and Repair, has been presented to the Secretary of the Navy. Among other matters in the way of standardization, it is stated that the Bureau has issued general specifications for electrical appliances on navy ships and for electrical conductors in navy yards. During the last few years the ventilation of naval vessels has been obtained largely by electric fans. These have many advantages in practical operation over steam-driven fans. There was great lack of information, however, as to the real efficiency and delivery of the fans hitherto installed. Using apparatus especially designed for this purpose, the Bureau has caused comprehensive experiments to be made at the Washington Navy Yard during the last year upon the efficiency of fans of various commercial makes, and has supplemented these by special experiments upon ventilation systems installed upon the *Missouri*.

On all of the recent men-of-war of importance a number of water-tight doors and hatches, some or all of which are left open under ordinary conditions, but must, for the safety of the ship, be closed promptly in case of accident, have been fitted with mechanical appliances for controlling them and closing them from a distance as well as on the spot. Pneumatic appliances have been fitted upon nearly all doors in the service, but the bureau has been anxious for some time to extend the use of electricity to these fittings, provided reliable electrical apparatus could be developed. With this end in view, it had tests made during the year at the Washington Navy Yard of several types of electrically-operated water-tight doors with distant control, the doors and operating devices being tested for endurance as well as water-tightness. Types of electrically-operated horizontal sliding doors and hatches have not yet been approved, but experiments are still in progress, and it is expected that satisfactory fittings will be determined upon in the near future.

The Bureau has investigated existing types of electrical steering gear with a view to its use upon naval vessels, and has designed and purchased the material necessary for the installation of electrical steering apparatus on the monitor *Nevada*. The results of the trials of this steering gear when completed will, it is hoped, furnish ground for its further extension in the service. The importance of the absolute reliability of the steering gear of vessels renders it necessary, in the opinion of the Bureau, to proceed in this matter with extreme caution.

Factory Turbo-Generator and Electric Power Distributing Plant.

One of the first large manufacturing concerns in the country to recognize the great advantages of electric power distribution in factories was the B. F. Goodrich Company, rubber manufacturers, of Akron, Ohio. Their plant consists of a large number of buildings, and when it was operated by steam power it was necessary to have a number of steam engines located at different points, owing to the limitations of the steam drive. When it was decided to adopt electric power, a central generating station was erected near the center of the electrical load, direct-connected generating units were installed and the electric motor drive substituted for the former steam and belting system. Two 500-kw generators and one of 150 kw were installed in the central station and space reserved for another 500-kw generator. The plant, however, soon proved inadequate, owing to unforeseen factory extensions, and in order to install a sufficient additional capacity of direct-connected units of the same type as those in use, an addition to the power house would have been required. It was found, however, that in the space reserved two turbo-generators could easily be installed, one of 750 kw and another one of 400 kw. Should further increase of power be necessary the 150-kw engine-driven machine may be replaced by two 400-kw turbo-units. It will thus be seen that a power house originally laid out for an ultimate capacity of three 500-kw and one 150-kw machines may, with turbine machinery, be arranged to accommodate 2,950 kw, or an increase of 80 per cent., and still retain the two original 500-kw engine units.

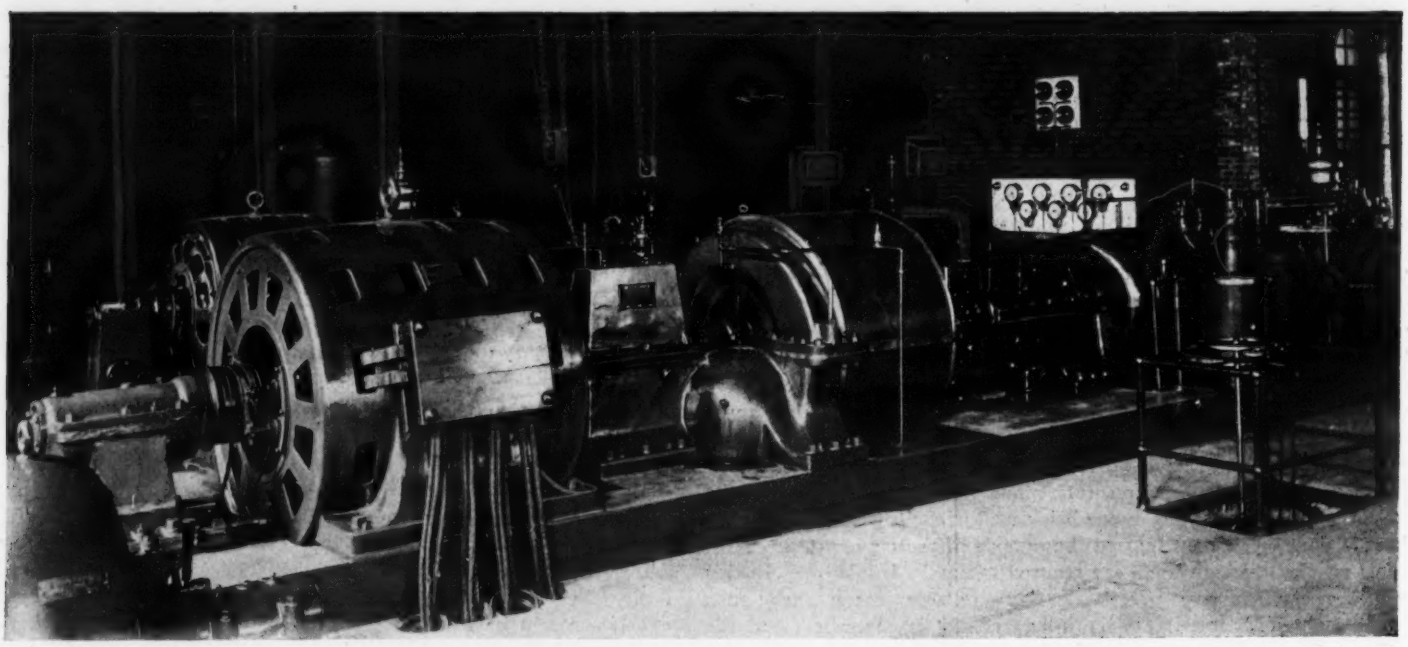


Fig. 1.—View of Turbo-Generator from Generator End.

As stated above, the steam turbine addition to the plant consists of two units of 400-kw and 750-kw capacity, respectively. Both are of the Westinghouse parallel flow type, the smaller turbine being a single-cylinder and the larger a double-cylinder machine. Both turbines are direct-connected through semi-flexible mechanical couplings to two-phase, 220-volt, 60-cycle dynamos, arranged at the switchboard to operate in parallel with the three engine type generators. The smaller machine operates at 3,600 r.p.m. and the larger at 1,800 r.p.m. An overload capacity of 50 per cent. is provided by by-pass valves at the side of the turbine. These also enable the machines to carry full load continuously should the condensing system break down.

It is interesting to note that in the case of the 400-kw unit, no foundation was constructed, the turbine being supported partly upon a brick wall which had been part of the former building foundation, and partly upon I-beams spanning the condenser pit. This unit rests directly upon the power house floor. The 750-kw unit rests at the four corners upon four brick and concrete piers, 12 ft. in height, tapered from a width of 2¾ ft. at the top to 4 ft. at the bottom. An 8-ft. passageway between the piers provides access to the receiver and piping. The condenser pit is spanned by two 12-in. I-beams, one under each side of the bedplate, which is continuous, and provided with longitudinal and transverse ribs giving great strength and rigidity. Approximately 12 per cent. of the area of the bedplate constitutes the area of support of the piers, the remainder that of the steel beams, which, to prevent flexure, are reinforced by struts at the center.

Both turbines operate condensing in conformity with the remainder of the plant, and are connected to a single condenser located immediately beneath, in a concrete-lined pit in the basement. Two vertical outlets communicate directly with the exhaust outlets of the turbines through gate valves and corrugated copper expansion joints, the latter being required to prevent distortion of the turbine shell by longitudinal expansion and contraction of the vertical exhaust piping. The directness of the exhaust line avoids the serious losses of vacuum incident to long lines of exhaust piping with many turns. It is in all respects equivalent to locating the condenser at the turbine outlet, as in the practice lately introduced in the case of large vertical engine type units.

A feature of the condensing system is an arrangement for cooling and abstracting saturated air. For this purpose a tubular vapor cooler is located in the lower part of the condenser head directly in the path of cold circulating water entering the condenser. A rotative air pump located beside the turbine foundation is piped through this vapor cooler to the condenser shell, thus serving to remove the vapor collecting in the top of the shell. In passing through the cooler the moisture condenses and the dry air is drawn off by the air pump. With this separation of the functions of dry and wet pump, each may be better adapted to their respective duties, resulting in more effective performance and higher vacuum.

The aggregate electrical plant now installed comprises 2,300 kw in generating machinery and about 4,000 hp in motors, divided in the approximate ratio of 3 to 7 between direct-current, variable-speed, and alternating-current, constant-speed induction motors, respectively. The entire generating plant is 220-volt, two-phase, 60-cycle, furnishing current to one switchboard, from which part is delivered directly to an alternating-current distribution system and part converted into 320-volt, direct-current by two 200-kw rotary converters, these in turn supplying a direct-current, three-wire distribution system.

An important feature of the electrical plant is the application of the three-wire balancing coil system to direct-current, variable-speed work. The advantages of the three-wire distribution were in the present instance of prime importance, both on account of the reduction of distribution losses and particularly the range of voltage necessary for variable-speed motor work. The balancing coil system permits the use of one generator or rotary converter instead of two as would be required in the ordinary three-wire system. It was thus possible to install larger machines with the attendant advantages of

less sensitiveness to, and greater capacity for, sudden loads. A diagram of the system is shown in Fig. 4, giving the switchboard and rotary connections. It will be observed that no special apparatus is required for the three-wire system outside of the two balance coils, which are simply single-coil transformers mounted in standard transformer cases in any convenient location. In this case they are suspended from the basement ceiling. The rotaries are standard machines in every particular.

Throughout both alternating and direct-current distribution systems secondary buses have been installed in buildings where considerable power is required. The buildings are usually divided into five independent sections, each served by a secondary bus. These are fed by heavy cables carried from the power house bus through a system of tunnels used in common with the factory distribution systems for water, air, steam, signals, etc. In cases of especially concentrated loads such as occasioned by the 200 and 300-hp motors, special feeders are run from the power house in order to secure better voltage regulation upon the remainder of the motor and the lighting systems.

With the exception of two large engine drives located in buildings close to the power house, the motor drive is used for every class of work from the heaviest rolls and calenders down to machines requiring a fraction of a horse-power. The complete list of connected motors comprises about 1½2 hp induction motor machines, five of which are of 300 hp each; 13 direct-current, variable-speed machines, five of 100 hp each, and several motors arranged with automatic control for operating freight elevators. A large number of the motors are used for driving special machinery, but in the majority of cases the drives are of the simplest character. For group driving, the motors are generally bolted to the ceiling and belted directly or through countershaft, if necessary, to sectional line shafts. This applies to machinery adapted to belt driving from above. A similar arrangement is employed in the machine and wood-working shops for driving shop tools.

There is, however, a considerable amount of special machinery which it is necessary to drive from beneath in order to preserve clear head room above the operating tables. In these cases the motors are either mounted on the floor beneath the tables or at-

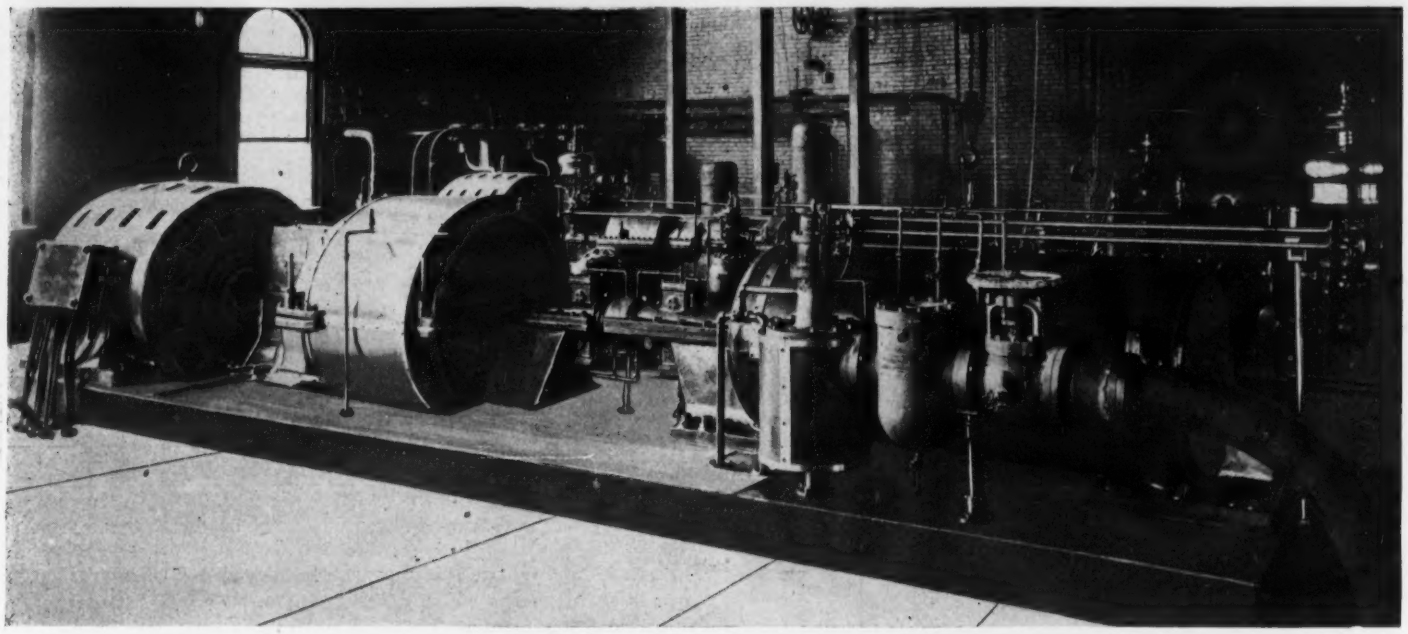


FIG. 2.—VIEW OF TURBO-GENERATOR FROM TURBINE END.

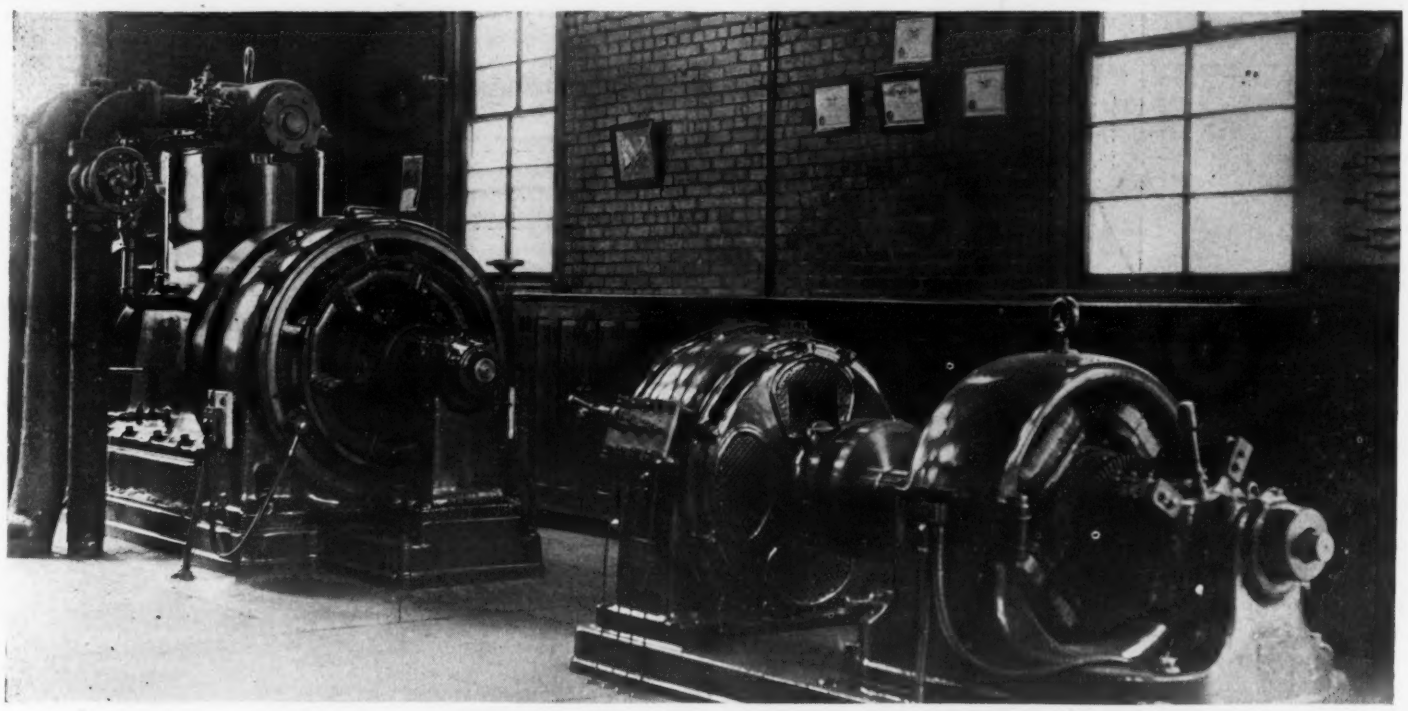


FIG. 3.—EXCITER UNITS.

tached to the ceiling below, and some form of transmission gear employed. In cases where plenty of room is available, rubber belting is used, but in restricted locations, such as floor drives. Morse or Renolds silent chain gear is employed, these being partially or entirely enclosed in sheet-iron cases, according to their liability to become clogged with dust or grit. The ceiling drives with chain gear above mentioned are perhaps the most unusual. The chain is kept lubricated by oil and graphite and protected by sheet-iron cases. Rotation is imparted to the vertical shaft through steel and rawhide bevel gearing, a similar arrangement being employed upon the floor above for driving a horizontal line shaft.

In a few instances variable speed with inverse torque is obtained by means of an adjustable pulley. Thus an expressing machine is served by a 10-hp induction motor running at 840 r.p.m. and mounted upon the floor level. It is geared through a Renolds silent chain to a Reeves variable-speed pulley. The chain gear effects a speed reduction of 1-4 and a speed ratio of 12:40 is secured by the Reeves pulley, with a maximum torque at the commencement of the expressing process.

Large induction motors of 150 to 300 hp are geared with a ratio of 1:5 directly to massive crude rubber rolls, one motor being

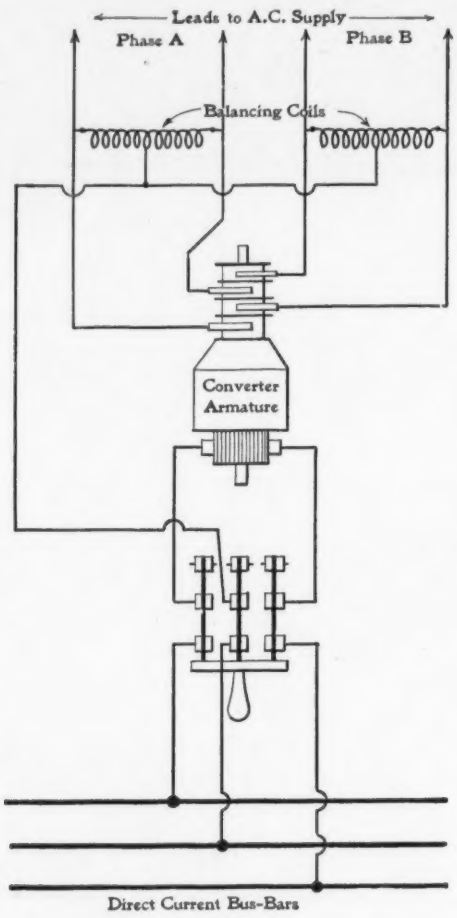


FIG. 4.—BALANCING COILS FOR DIRECT-CURRENT DISTRIBUTION.

usually located between two rolls which it drives. A standard starting box is used with the smaller motors. To prevent sudden overloading of the power station due to the simultaneous starting of a number of the larger motors, a simple signal system has been put into use with the object of reducing the amount of reserve machinery otherwise necessary. The system consists of whistle alarms located near the 300-hp motors supplied from a compressed air system and operated by a magnet controlled by a push button upon the switchboard. A similar device controlled by the motor attendant is used to warn the power house of an increase of motor load. By this system the switchboard attendant is able to notify the motor attendant when the load upon the power house is so heavy as to necessitate the placing in operation of an additional generator to carry the increase.

The large direct-current motor drives are of interest by reason of the variable-speed feature. The motors are installed in a concrete pit and geared to the rolls through a heavy Morse "silent chain" reduction gear. Further speed reduction is accomplished by massive toothed gearing. The motors are of 100-hp capacity and each is provided with a standard controller located in front of a motor panel containing switches, circuit-breaker and instruments. The controlling outfit is located close to the rolls operated, so that absolute and constant control of the process is possible. The controller has nine points giving 18 different speeds, with the two voltages available upon the three-wire system, namely, 160-320. Resistance in both

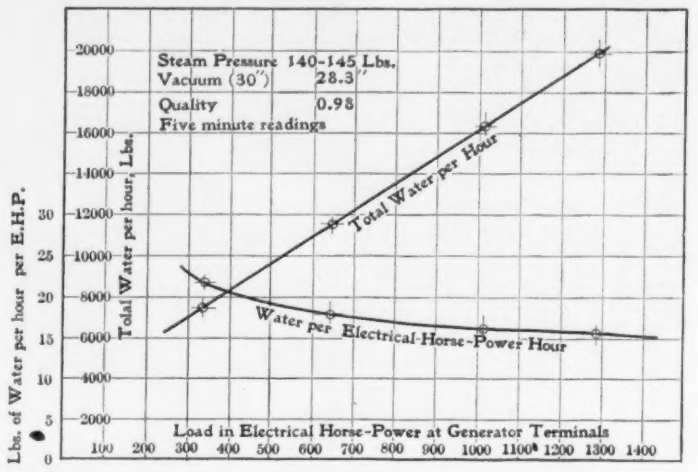


FIG. 5.—CURVE SHOWING PERFORMANCE OF TURBO-GENERATOR.

armature and shunt winding are employed to effect the proper gradation of speeds which range from 100 to 500 r.p.m.

Current for lighting the entire works is obtained from a two-phase distribution system supplied directly from the power station bus in order to render the illumination independent of the local fluctuations due to motor load. In all cases 110-volt lamps are used upon each 220-volt lead, a neutral being introduced to equalize the unbalanced current. This neutral is connected to the central point of an auto-transformer or balancing coil, which serves to preserve, within reasonable limits, equal voltage upon the two sides. During Sundays and holidays, when the main plant is shut down a small 125-volt, direct-current generator is connected to the lighting mains.

The accompanying table and the curves of Fig. 5 give the result of a shop test of the 750-kw Goodrich turbo-generator, made February 28, 1903. The readings were taken at intervals of five minutes,

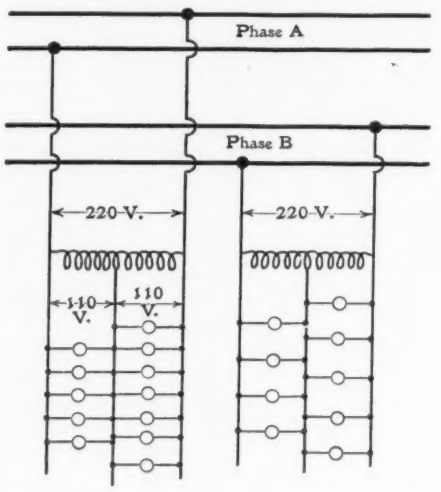


FIG. 6.—BALANCING COILS FOR ALTERNATING-CURRENT DISTRIBUTION.

and an allowance made of 352 pounds of water per hour for condenser leakage.

Test No.	1	2	3	4
Steam pressure	140.20	140.30	145.00	145.00
Quality steam	.977	.98	.984	.982
Vacuum (actual)	27.06	27.03	27.00	27.18
Vacuum (30" bar.)	28.36	28.33	28.30	28.48
Load, K.W.	961.00	756.00	481.00	250.00
Load, E. H. P.	1288.00	1015.00	645.00	335.50
Water per hour	19899.00	16265.00	11551.60	7304.00
Water per E. H. P.-hour	15.43	16.01	17.90	21.75
Duration of test, hours .	2	1	1	1.

A most striking feature of the plant as a whole is the harmonious

operation of two radically different types of prime-movers in parallel, and the ease and accuracy with which a definite subdivision of load may be predetermined. The turbine machinery, being last installed, was necessarily obliged to conform in all respects to the conditions already obtaining in the engine plant. It is, therefore, the more noteworthy that satisfactory operation in parallel has been secured. The turbine governors were designed for a definite sensitiveness. This proved to be somewhat greater than that of the engine governors, with the result that the burden of a sudden load would fall upon the turbines and cause an instantaneous checking in speed. This action induced a more or less severe surging effect between the two parts of the plant. This effect was easily remedied by cutting out of service a number of coils of the governor spring by means of a special nut mounted upon the governor sleeve. The adjustment of this nut determines the sensitiveness of the governor to sudden loads, and has been adjusted upon the two turbines, so that the turbine plant assumes somewhat more than its share of load during fluctuations, which is permissible on account of the high inertia of and the absolute uniformity of speed of the rotating parts. The effect is further distributed between the two turbines in inverse ratio to their respective capacities.

The adjusment for steady loads is, however, quite distinct from that for fluctuating loads. The former is a question of spring tension and the latter of spring stiffness. The tension adjustment may be made while the machine is running, as the entire spring mount is attached to a sleeve surrounding the governor spindle and working between ball bearings. This tension adjustment enables any divisions of load to be secured as indicated by the switchboard meters. It is also used for synchronizing. In practice, however, this is accomplished by a simple method, as follows:

The speed of the turbine is brought a little above that of the engines already running, so that a slow blinking of the synchronizing lamps is observed. By resting the finger lightly upon some part of the governor mechanism the speed may be brought down sufficiently to produce absolute synchronism for as long a period as desirable, even as long as one minute if the load happens to be steady. By this means the tension adjustment need never be changed, as the slight excess speed necessary to synchronize is not appreciable when the machine is under load. In this instance the large turbine is usually given more than its share of load owing to the controlling influence exerted upon the engine plant. Sudden loads which would perceptibly check the engines prove imperceptible in the case of the turbines, a beneficial result which is felt throughout the entire motive power system. No synchronous motors are employed, but rotaries and induction motors are more or less sensitive to fluctuations induced by sudden loads.

It thus occurs that the turbine plant, in addition to furnishing a substantial margin of capacity for both sudden and steady loads, also performs the duty of frequency or speed regulator by reason of inertia effects. During the twelve months of its operation no troubles have developed pointing to faulty design or construction, and the satisfaction derived from daily operation affords the surest indication of the fulfilment of expectations. It is a noteworthy fact that the 400-kw unit sustained at one time for a period of seven successive hours a load of 700 ehp or an overload of 30 per cent. without difficulty or injury. Striking proof of the low friction losses in the steam turbine is offered by the fact that if the vacuum is maintained at the closing of the turbine throttle, these machines will continue to revolve for thirty to forty minutes. Although this phenomenon is partly due to the high inertia of the rotating parts, it is, however, significant of high mechanical efficiency. By admitting air through a small valve the motion may, however, be greatly retarded—an expedient used when a quick stop is desired.

The cost of the turbine generating plant is stated by the owners to be about the same as a high-grade engine-generating plant. The increase in the cost of condensing machinery suitable for high vacuum is offset by the low cost of foundations, so that the choice of engine or turbine finally resolves itself into a question of floor space, efficiency, all-day economy, overload capacity, and regulation of alternating systems; and it is claimed that in all of these points the turbine plant has proven superior.

The above information regarding the Goodrich plant has been obtained through the courtesy of the B. F. Goodrich Company, the Westinghouse Machine Company, builders of the turbines, and the Westinghouse Electric & Manufacturing Company, which installed the entire electrical plant.

The Beznau Hydro-Electric Plant, Switzerland.

Probably one of the most interesting electric plants in Switzerland is that at Beznau. It is owned and operated by the Beznau Electricity Works, near Waldshut, and has a capacity of 10,000 hp. This installation is equipped with vertical generators directly driven by vertical shaft turbines. Each unit has a capacity of 1,000 hp and operates at a speed of 66⅔ r.p.m. The generators are of the three-phase revolving field type, with stationary external armatures. These machines can be seen in Fig. 1, the view of which was taken from the switchboard gallery. The alternators generate current of a frequency of 50 cycles per second and a potential of 8,000 volts. This plant was installed by the Actiengesellschaft Brown, Boveri & Co., of Baden, Switzerland.

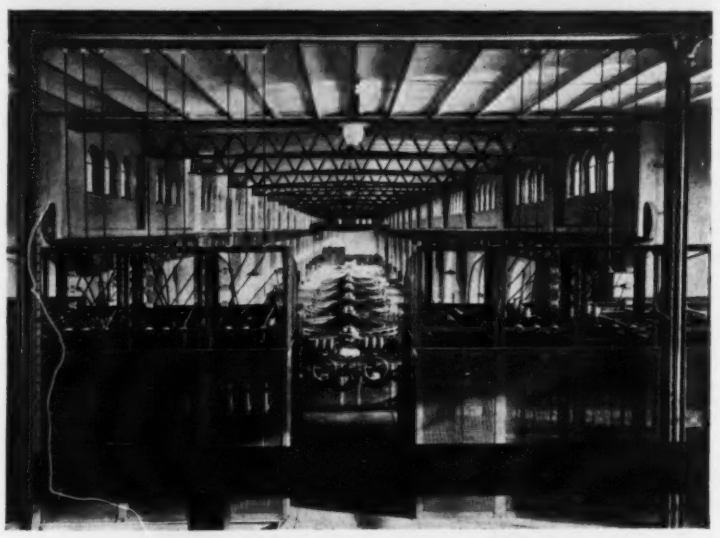


FIG. 1.—GENERAL VIEW OF GENERATOR ROOM.

The generator switchtable and feeder panels may be noted in Fig. 2, while the ingenious method of protecting the attendants from the high-tension wires is illustrated in both views, at the switchboard gallery. The transmission line is supplied with current from a number of step-up transformers, each of which has a capacity of 910 kw. The pressure used on the long-distance transmission line is 26,000 volts and at the various sub-stations the current is lowered in pressure for distribution for local lighting and power purposes.

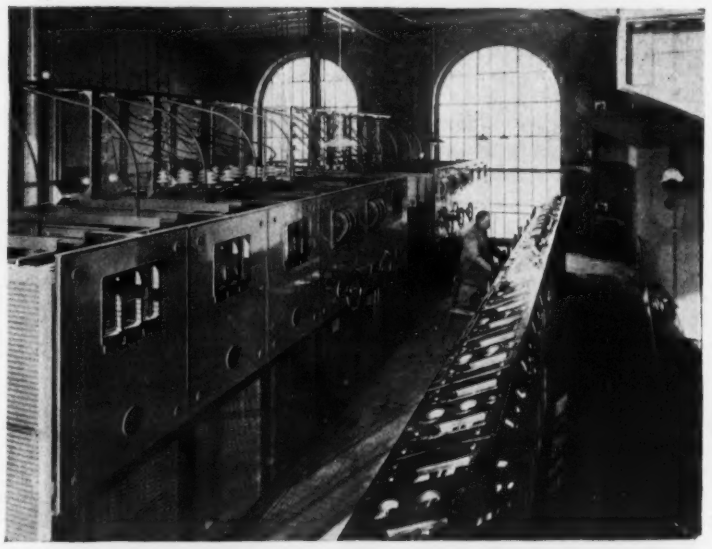


FIG. 2.—GENERATOR SWITCHTABLE AND FEEDER PANELS.

Southern Indiana Telephone Association.

The fourth annual convention of the Independent Telephone Association, of Southern Indiana, will be held at Evansville on November 10 and 11. An interesting programme will be provided. An invitation is extended to manufacturers to exhibit their goods. Mr. E. W. Pickhardt, Huntingburg, Ind., is the secretary of the association.

Convention of the Southwestern Electrical Association.

As noted in our issue of last week, the first meeting of the Southwestern Electrical Association was held at Oklahoma City, October 9, 1903. The Association starts with 35 active and 11 associate members, the former representing the several electric light, railway and telephone companies of Oklahoma, as well as several plants in Arkansas, Texas and Kansas. The list of officers elected was given in our last issue, and we present herewith portraits of Mr. John W. Shartel, the president, and Mr. John Lowry Ellis, the secretary.

Mr. Shartel, who is a native of the State of Pennsylvania and a railroad corporation lawyer by training and profession, is secretary and counsel of the Metropolitan Railway Company, of Oklahoma City, and president of the Oklahoma Traction Company, which latter is constructing a line of interurban railway between Oklahoma City and Guthrie and a street railway system at the latter place. Mr. Shartel, in 1901, resigned as solicitor for Oklahoma Territory of the Choctaw, Oklahoma & Gulf Railroad Company, to enable himself to devote a greater portion of his time to the development of electric railway enterprises. He organized the Metropolitan Railway Company, of Oklahoma City, in January, 1902, and directed its construction. In the early part of the present year he organized the Oklahoma Traction Company, which enterprise he has placed on a working footing. Mr. Shartel has lived in Oklahoma Territory for the past eleven years and has been largely identified with both its political and material development.

Mr. J. L. Ellis, the secretary and treasurer of the Association, was born in Kansas and brought up in Tennessee. His first electrical

President John W. Shartel.

Secretary John L. Ellis.

experience was running at the age of 15 a 30-light Jenny arc machine in Shelbyville, Tenn., located in a mill. During the greater portion of the season the generator of the machine was driven by water power, but when the water was too high or too low the mill engine was coupled on. Mr. Elllis resided in Indianapolis about ten years and was identified with the then Varney & McQuat Company, as wireman, foreman of construction and traveling salesman. Mr. Ellis traveled out of Chicago for several years, after severing his connection with the above company. He came to Oklahoma in March of this year and is engaged in selling heavy machinery, water works materials and supplies, as manufacturers' agent. While Mr. Ellis has had no technical education, he has a thorough practical training in the electrical business.

For the government of the Association, the constitution of the Ohio Electric Light Association was adopted with a few minor modifications. In addition to the officers elected mentioned in our previous issue, the following executive committee was named: T. K. Jackson, Enid, Okla.; W. K. Berry, Ardmore, I. Ty.; S. P. Render, Oklahoma City, and W. E. Robinson, Oklahoma City.

Mr. John W. Shartel, in a paper, discussed the possibilities of electric railways in Oklahoma and Indian Territories. He stated that there are several communities in the two territories located in sufficient proximity to make an inviting field for the construction of interurban lines, and future development bids fair to bring others into similar relations. He emphasized the fact that many electric railways have been laid down without sufficient consideration of their future profitability, and urged that the traffic problem should be very thoroughly investigated before the construction of a street railway is undertaken. While an interurban population of at least 10,000 is usually required to make a street railway profitable, yet experience has shown that no fixed rule of the kind can be imposed, and it is now recognized that 10,000 people located in a favorable condition for street car patronage involve a better condition than a community of 25,000 people in a local environment such that they may or may not ride as they feel disposed. The most favorable conditions are when the greater portion of the population is located some distance from the business center, or when a city is spread out over a narrow belt. If a street railway system can be united with interurban service, the proposition becomes much more favorable, for the difference in the cost of maintenance of a power house for 4 miles and for 15 miles of railway is measured chiefly by the fuel bill. Many a street railway system in this country which has been dragging a miserable existence, has been saved by interurban connections, and many a town or village which would be wholly inadequate to support a street railway system has enjoyed the benefit of that facility from interurban railways passing through them.

Mr. Shartel strongly urged that when an electric railway is put down it should be built in the most substantial manner; one mile of track constructed for 40 or 50-pound rails will require more attention and care than five miles constructed of 60-pound rails, and this is merely an illustration of the burden of maintenance between a poor and good construction. He recommended that wherever possible an electric railway plant should be operated in connection with an electric light plant. Such a plant divides the power house expense in two, and it affords an opportunity which could not otherwise be obtained for selling electricity 24 hours in the day.

In a paper entitled "The Accounting as Kept By a Central Station Man," Mr. U. S. Hart, of Shawnee, Okla., dwelt upon the economies that may be obtained by a proper system of central station accounting. He recommended that all coal should be weighed, each watch turning in the number of pounds consumed during its tour and also the minimum and maximum pressure carried on the boilers. By making such reports firemen soon learn to practice economy, as they lead to rivalry between the different watches as to which shall keep the coal consumption per kilowatt-hour output lower than the other. The engineer should keep a full log. For keeping track of the line poles and transformers, Mr. Hart uses, in addition to a map, pole cards on which are indicated the position of the wires, transformers, etc. When a change is made new cards are issued covering the changes. Each transformer has a card issued giving all its data with spaces to fill in the service numbers or the names of the consumers and number of lights to each service. By this means one can tell in an instant the number of lights on a transformer. A consumer's record is kept very similar to a depositor's record in a bank, each page holding the year's business crosswise, instead of up and down, all accounts being arranged alphabetically. This record is ruled for name, street, number, service number, date cut in, date cut out, rate, amount, discounts in deduction, cash book page, and for several other entries. By this means the business of each month and the amount of collection agrees with the cash book, thus furnishing a positive check. The total of deductions, amount paid and delinquencies, balance the total change as indicated in the total column. One is also thus enabled to compare the discounts each month and the delinquencies forwarded each month, with the previous months, and the months of the previous year, etc. Mr. Hart strongly urged that the standard system of accounts prepared by the National Electric Light Association be adopted by central stations.

Mr. Theo. K. Jackson, of Enid, Okla., read a paper entitled "Benefits Derived from Heating from Central Stations," which subject was discussed under the heads of heating with steam and heating with hot water. He considered that steam heating has an advantage where there are great variations in altitude and where tall office buildings, etc., are to be supplied. It is impractical to pump water to great elevations not only because of the additional cost of pumping, but also because special radiators are necessary to stand the high pressure required. Mr. Jackson's experience is that 40 pounds is the highest pressure that is safe to put on the average radiator after it has been in service some time, even though the radiators were originally manufactured to stand a pressure of 100 pounds. The disadvantages of steam heating are that owing to the higher temperature, the loss in radiation is greater and the system has no elasticity with respect to the regulation of the temperature.

He considered that where it is applicable heating with hot water is preferable to heating with steam, for the reason that the temperature can be controlled and therefore the loss of heat in transmission from point to point is greatly reduced. For example, hot water heating can be carried on at a temperature of 140°. The single-pole system

for hot water heating cannot be used when a central station supplies more than 40,000 or 50,000 sq. ft. of radiation, as the water delivered in the last radiator would be much colder than that delivered in the first radiator. The double-pipe system is, therefore, preferable except in special cases. Several systems of central station hot water heating are described, and Schott "balanced column system" is spoken of favorably. In this system the water is not pumped into an expansion tank, but returns direct to the circulating pumps, the leakage loss being supplied by an additional pump called the "balance column pump," and the expansion cared for by a safety valve. The circulation pumps obtain the benefit of all return pressure, and only supply an amount of energy corresponding to the friction of the water passing through the system; on the other hand, with the expansion tank system the circulating pumps have to supply energy equal to the full head pumped against. It is stated that the column system saves about one-half of the cost of pumping water.

As to rates of charge for heating, a proper basis is stated to be a charge based upon a calculation of the heat required for a given space; such a calculation may be made by means of Carpenter's rule, which takes into consideration the cubic contents, square feet of glass surface and square feet of exposed wall. A cheap and efficient method of insulating the pipes is to lay them in boxes made of three or four layers of wood with air spaces between the layers, the outside of the box being covered with pitch or some other water-proof material. All openings which would allow of the circulation of air, such as manholes, expansion joints, etc., are calked with oakum. The use of thermostats in consumers' houses is recommended, and all exposed pipes should be lagged. It is stated that to make heating from central stations a success, there should be sufficient exhaust steam to take care of the connected radiation during about two-thirds of the heating season. It is not profitable to operate with live steam, and those not having sufficient exhaust steam available should keep out of the heating business. The conclusions of Mr. Jackson are that from the consumer's standpoint central station heating is a great success; and that from the manager's standpoint it is a financial success when there is cheap steam fuel and the cost of anthracite coal is high, where there is a well-balanced load, where there is proper construction both in the consumer's residence and in the central station, and where the rates of charge are fixed on a proper basis.

Local Sections of the American Electrochemical Society.

Following are the regulations adopted by the American Electrochemical Society governing the formation and conduct of local sections:

A local section may be authorized by the Board of Directors, at the written request of three members. Only one section shall be authorized in any one locality.

Any member of the Society, in good standing, may enroll as a member of any local section, provided he complies with the regulations of the said section. Only members of this Society are eligible to membership in its local sections.

The regulations of local sections are subject to the approval of the Board of Directors.

The expenses of each local section shall be borne by the members enrolled in said section. The Society shall not be responsible for any debts contracted by a local section or the officers thereof.

The Society will print copies of papers offered to local sections, in order to facilitate full discussion thereon, provided that said papers are approved for such advance publication by the chairman of the local section and by the publication committee of the Society.

Papers read before local sections, and discussions thereon, if reported, are to be considered as the property of the Society and published in the *Transactions* if approved by it. Reading of a paper before a local section does not, however, carry with it the right of publication in the *Transactions*.

Papers read before local sections may be offered for reading at General Meetings of the Society, and will be given equal standing with other papers on the programme of said meeting when approved by the committee on papers.

The Board of Directors reserves the right to abrogate, amend or add to the above regulations, or to pass upon questions concerning the welfare of local sections not covered by the regulations.

Permission has been granted for the organization of a local section at Madison, Wis., and at New York City.

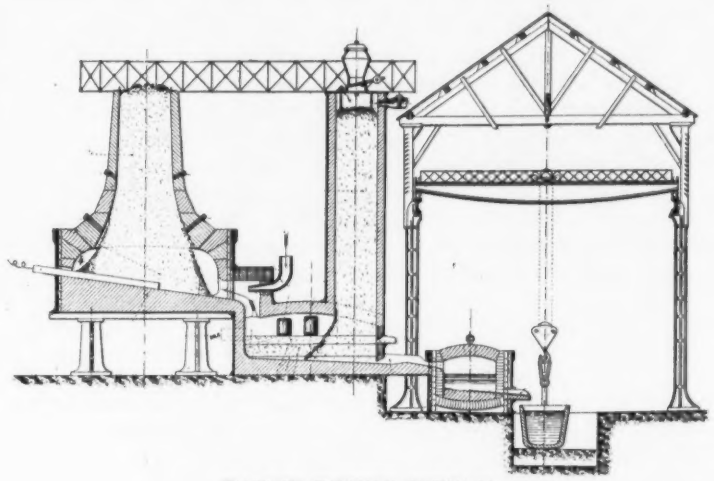
Recent Electrochemical Developments.

ELECTROMETALLURGY OF IRON AND STEEL.

Three patents were granted on October 27 to Mr. Henri Harmet, of St. Etienne, France, who is well known as the inventor of an electric iron and steel process in which the iron ores are converted into iron and steel by a series of three operations, the ore being first reduced, then fused and finally refined. The inventor has now modified his process by reversing the order of the two first operations, the ores being first fused and the oxides then reduced prior to their treatment in the refining oven. These three operations are conducted in three distinct furnaces, which are connected together in such a way that the fused materials leave the hearth of the fusion chamber shown at the left of the accompanying illustration, to enter directly the crucible of the reduction chamber shown in the middle part of the illustration, and then running into the refining oven shown at the right. For this purpose the sole of each crucible is an inclined plane, as shown in the illustration.

The hot gases developed in the reduction chamber shown in the middle part of the illustration are used for heating the ores and fluxes charged into the top of the fusion chamber at the left. These gases are mainly composed of carbonic acid, and before entering the fusion chamber they are mixed with air under pressure forced through tuyeres indicated in the illustration by an arrow. Since the heat of these gases may not be sufficient to fuse the material, additional heat is produced electrically by means of the electrodes placed at the bottom of the fusion chamber.

Inasmuch as in the reduction chamber the reduction of oxides absorbs more heat than is produced by the transformation of the



HARMET ELECTRIC FURNACE.

carbon or coke-reducing agent into carbonic oxide, the crucible is heated by an electric current. This current is admitted through vertical electrodes, which enter the crucible to a depth so as to reach but not penetrate the slag of the crucible. The reduction takes place as follows: After working for some time a first layer of metal collects upon the sole of the crucible and is overlaid by a layer of incompletely reduced oxides, more or less mixed with a third layer of slag. The main column of coke, introduced through the vertical charging chamber, rests at its base upon the sole of the crucible, but fragments of the coke are lifted by the metal and slag and flow upon the liquid mass, spreading everywhere until they fill the entire lower portion of the crucible. The liquid mass then circulates in the spaces left between the fragments of coke as in ordinary blast furnaces. The melted oxides discharged from the fusion crucible at the left fall upon a mixture of coke and slag and are then reduced under the influence of the high temperature produced by the electric current. The reduced metal sinks to the sole of the crucible and there collects, the slag flowing on it. Before the reduced metal or the slag can be tapped through two tap holes at the right hand of the reduction chamber, they must both pass through the column of reducing carbon, which at the point where the metal and slag pass through it is in an incandescent state, thus completing the reduction.

The reduced metal then flows into the refining oven shown at the right hand. The refining operation in the regulator crucible is conducted in a manner analogous to that of the Martin refining oven. In many cases it is advantageous to have for each reducing chamber two regulators or refining ovens in which the crude metal

flows regularly as soon as produced. In this instance one of the regulators receives and becomes charged with the metal, while the other is bringing the refined metal to the point of hardness and composition required.

Two of the patents granted to Mr. Harmet refer to the processes just described and the apparatus used in this process. The third patent refers to an arrangement of a reducing furnace in a former patent with a view to facilitating provision of a large number of pairs of electrodes and of preventing the passage of the current through the liquid metal, its passage through the same being useless because the heat developed there is unable to pass to the solid matters through the layer of slag.

PRODUCTION OF CHLORIDES OF CARBON IN THE ELECTRIC FURNACE.

A patent was granted on October 27 to Dr. F. J. Machalske, of Brooklyn, for producing chlorides of carbon in the electric furnace by bringing a porous mass of broken carbon, heated to incandescence, in contact with chlorine. A mixture of sodium chloride and silica sand is charged into the lower part of an electric furnace and broken coke is charged upon the mixture. The mixture and the coke are heated simultaneously to a high temperature by means of electric currents, various sets of electrodes above each other being provided for this purpose. The sodium chloride melts and the silica dissolves in the molten chloride, liberating chlorine, which arises through the incandescent coke and combines with it to produce the carbon chlorides, which are then carried to a condensing chamber. The charge should be free from water and a non-oxidizing atmosphere should be maintained in the furnace. Various chlorides of carbon may be produced by varying the proportions of the ingredients of the charge or by varying the number of electric arcs in the furnace chamber above the charge.

ELECTRODEPOSITION OF METALS.

In the electrodeposition of metals electropositive to hydrogen (like nickel), a certain quantity of hydrogen depending upon the current density used, is liberated at the cathode simultaneously with the deposition of the metal. This hydrogen is partly occluded by the deposit, partly adheres thereto, and is partly dissolved in the electrolyte. It exerts an injurious effect upon the tenacity, density and other characteristics of the deposited metal. In the electrodeposition of metals electronegative to hydrogen (like copper) an evolution of gas may also occur at the cathode, especially when a certain limit of current density is exceeded. Such metals also are injuriously affected by the gas.

Two patents were granted on October 27 to Mr. Woolsey McA. Johnson, electrometallurgist of the Lanyon Zinc Company, for overcoming these disadvantages. The inventor has found that if the electrolyte is freed from gases before the metal is deposited therefrom, and especially if it be maintained free from gases during the plating operation, the quality of the separated metal is greatly improved, as indicated by its increased density, hardness and toughness, by its smooth surface, and by its freedom from microscopic cavities. As a means for maintaining the electrolyte in this gas-free condition, Mr. Johnson makes use of a partial vacuum over the electrolyte. To this end he exhausts the air from an elevated receiving tank which preferably contains a filter, and which is suitably connected with the electrolytic cell. Portions of the electrolyte are thereby transferred from the electrolytic tank to the filtering vessel and may then be permitted to flow again to the electrolytic tank. By providing several filtering tanks and using them alternately, the flow of the electrolyte is made continuous.

MISCELLANEOUS.

A patent has been granted to Messrs. M. Moest, H. Hertlein and E. Oppermann, of Hoechst, Germany, on the electrolytic reduction of organic compounds by means of titanium compounds. It has long been known that organic substances are most energetically reduced by titano salts. Thus titano chloride reduces nitro compounds to amins, unsaturated acids to the corresponding saturated acids, etc. The present inventors have devised a process permitting industrial application of titano compounds for reducing purposes, by conducting the reduction in an electrolytic bath. Very small portions only of the titanium compound are required in the electrolyte, so that in fact the former is merely a carrier of the electrolytic hydrogen. The electrolyte may be used again in many cases. In a great number of cases the reduction may be made also without a diaphragm.

A patent granted to Messrs. J. Miller and F. M. Ashley, of New York, relates to an ozonizer which has the essential features, structurally at least, of an ordinary Leyden jar, ozone being produced by silent discharges. It consists of a dielectric body in form of a tube closed at one end and with electrodes, one of which covers the extremity of the closed end of the tube while the other covers the inside surface of the tube and is turned back at the mouth of the tube so as to embrace externally a part of the mouth portion of the tube. At this point it is in such spaced relation to the electrode at the closed end of the tubes as to prevent the formation of the undesirable spark discharge.

Three patents for primary batteries have recently been granted to Messrs. W. Strickland, C. W. Roberts and J. A. Pedrazzi, respectively. Mr. Strickland provides the excitant in a dry granular or powdered form, so that the cell is set in action when water is poured into it. The purpose is to enable one to keep the cell in an inactive state without deterioration until it is to be used.

Mr. Roberts patents a battery which he says may be worn on the finger, and which is capable of being put into action by the moisture derived from the evaporation of the finger. It is claimed to be useful for certain physical experiments. It consists of a metal strip provided with dented edges holding a strip of cloth on which is a strip of zinc. The cloth folds over the edges of the zinc and the dentals fold over the edges of the cloth and zinc.

The battery of Mr. Pedrazzi comprises an outer casing and an inner porous cup, a solution of concentrated lye being arranged between the cup and casing. A vertically corrugated shell of zinc is arranged within the lye, while the porous cup contains a solution of copper sulphate in which are placed parallel plates of copper and alternating layers of copper wire binding the copper plates together.

Riding on a Zossen Car.

A special cable message from Berlin reports that Dr. H. S. Pritchett, president of the Massachusetts Institute of Technology, has the distinction of being the first foreigner to ride on the motor cars used in the high-speed electrical experiments on the Marienfelde-Zossen military railroad.

After riding in both the Siemens-Halske and Allgemeine cars last week, President Pritchett described his experiences and observations to the Associated Press. Both cars reached the speed of a hundred miles an hour. The chief of the government's military railroads, who was on board, would not permit a higher speed because of the fog which prevailed.

Dr. Pritchett was surprised at the steadiness of the cars, which did not create, so far as unevenness of movement was concerned, the impression of so great a speed as American trains running at 60 miles an hour, and the engineer assured him that the impression was the same when going at the rate of 130 miles. The groups of observers standing near the track presented a blurred image as the car dashed past. President Pritchett was afforded every facility for studying the experiments. He rode at the front and in the rear of the cars and noticed the enormous air suction at the rear platform.

From the observations which he made and from the figures submitted by the engineers, Dr. Pritchett does not doubt the commercial success of the motors up to a speed of 100 miles. He thinks that on roads between cities like New York and Washington, with low grades, few curves and heavily ballasted, a cheap system of electric traction would undoubtedly prove commercially profitable. Dr. Pritchett regards a speed above a hundred miles as being perhaps unprofitable, owing to the great expense of each additional mile. At any rate, Dr. Pritchett says, it is a great mistake to regard the Marienfelde-Zossen experiments as a mere scientific curiosity. Practical results of an important character will certainly follow.

The engineers indicated the hope that American capitalists would take the matter up and put it to practical use. They argue that the great boldness of American capitalists and the intense economic life in the Eastern States offer exceptional prospects for building the first successful high-speeding roads. Germany is too poor and too little developed to take the matter up at present. One of Emperor William's ideas is an electric road between Berlin and Hamburg. His Majesty has shown the deepest interest in the Marienfelde-Zossen experiments throughout.

Before going on board the cars Dr. Pritchett had to sign an agreement fully exempting the company from any claims for damages in case of accident.

New Telephone Patents.

COMMON BATTERY SWITCHBOARD CIRCUIT.

It is probably safe to say that the switchboard connecting cord is the most vulnerable part of the switchboard equipment, receiving necessarily a maximum amount of wear and tear from the very nature of the functions it must perform. Most maintenance men consider that the cord caused its full share of trouble and expense when, as in the magneto system, it consisted of two conducting strands. With the advent of the common battery system wherein until recently three conducting-strand cords have been universally required, and the requirements for satisfactory working greatly increased over those of magneto working, cord trouble became an even greater item. Improvements in cords have been made to largely meet the increased demands upon them, but nevertheless many gladly hail the recent adoption by some manufacturers of central energy systems wherein but two strand cords are required. Of course, one must not infer that the difficulties with three-strand cords played an important part in determining the adoption of the so-called two-wire systems, for they most probably did not. However, the use by these systems of a two-wire cord is most surely an incidental point well in their favor.

Quite a number of these two-wire systems have now been developed, the latest being the subject of a patent granted to Kempster B. Miller, of Chicago, and assigned by him to the Kellogg Switchboard & Supply Company. This system is quite different from the earlier Kellogg systems, being arranged with a repeating coil cord circuit. In Fig. 1 are shown the circuits in principle and detail. From the two batteries, *r r'*, circuits may be traced through the wires, 3, to the subscribers' stations, *A* and *B*, these circuits passing through the back contacts of the relays, *b b*, and being normally open at the subscribers' switch hooks only. The line relays, *C C*, being included in these circuits, of course respond to any closure of the circuit at their respective stations to indicate in the usual manner the arrival of a call. The operator responds with her plug, *p*, through the spring jack, *d*, elevating slightly with the plug tip the corresponding jack spring. Now, moving with this spring, but insulated therefrom, is the spring, d^3, which brings up against contact, d^4. This closes the circuit of relay, *b*, which operation transfers the line wire springs from the battery to the jack contacts. In addition, the contact, a^4, grounds the test rings, d^5, of all the jacks of line *A* to provide a busy test. Referring now to the cord circuit, it is found divided into two sections by the repeating coil, *w*. Across either section is a double-wound relay, between the windings of which

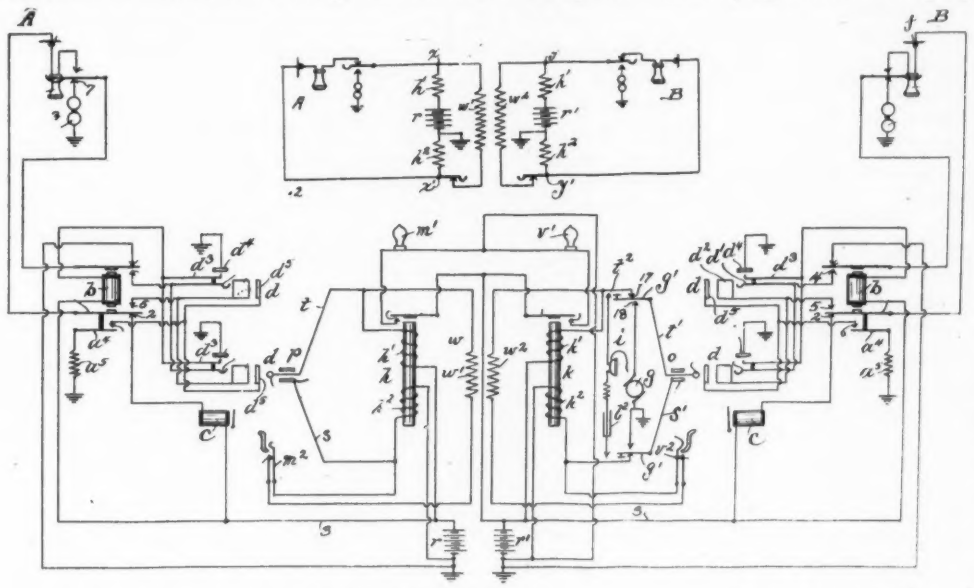


FIG. 1.—MILLER CENTRAL ENERGY SYSTEM.

is connected the corresponding central battery. Now, the plug, *p*, being in jack *d*, battery *r* sends current to subscriber *A* through relay *h*. This relay, *h*, does not respond, however, because of the differential relations of its windings. Battery *r* also sends current through another circuit. This, too, involves relay *h*, passing therefrom through repeating coil winding, *w'*, and contact, m^2. Now, when the operator completes the connection to subscriber, *B*, exactly similar conditions pertain except that the relay, k^7, operates until the currents in its two windings are equalized by the removal of the bell ground by the response of *B*.

It was noted that a circuit was made from each battery through the corresponding part of the repeating coil and differential relay, and consideration of this circuit shows that the control of it lies solely in contacts m^2 or v^2. These are plug socket switches, and are opened by the return of the connecting plugs to their seats to prevent the waste of current through this coil circuit when no call exists. These plug socket switches are a most objectionable feature undoubtedly, but they are necessary to the system and must be used irrespective of the fact that their disadvantages probably out-

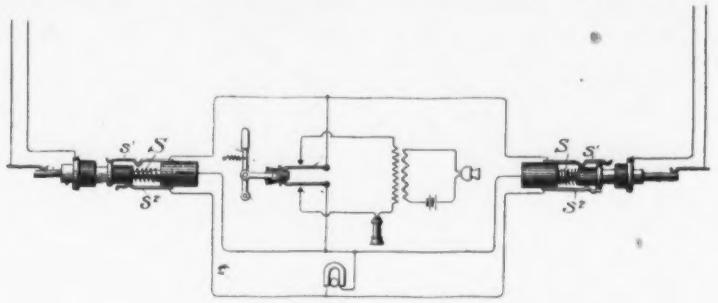


FIG. 2.—PRENTISS SWITCHBOARD.

weigh any advantage which may have been introduced over other two-wire systems.

SIGNALLING PLUGS.

Another recent patent is that of S. B. Prentiss, of Washington, D. C., which describes a design of plug and arrangement of circuit such that separate ringing keys are dispensed with. Earlier systems have been arranged to cause a signal to be sent out on a line by an excessive pressure upon the base of a plug inserted in the line jack, but in these systems at least a portion of the ringing circuit and device was associated with the jack. Mr. Spenser thinks it better to include the whole device within the plug, basing his judgment upon the ease of replacement and repair of this part of the equipment.

Fig. 2 shows the arrangement of this invention, the plug at the left being in the normal and that at the right in the ringing position. Little explanation seems necessary, the figure clearly showing how when the base of the plug is depressed against the pressure of the spiral spring, *S*, the spring, *S'*, clears the sleeve of the plug while the ringing spring, S^2, contacts therewith.

PREVENTING CHATTERING OF RELAYS.

With certain central energy systems wherein a relay is required to maintain the continuity of a subscriber's line during connection between his station and the line jacks, trouble has been experienced when an attempt has been made to signal by pulsating currents in party-line work, because of the chattering of the controlling relay during the application of the pulsating current.

Mr. David F. Stokes considers that this chattering is due to the discharge of the subscriber's station condenser in the interval between impulses of current, this discharge taking place to earth through the controlling relay, and being of an opposite sign from the normal current it releases the armature. He has found a remedy for this effect in the shunting of the relay by a high-resistance, non-inductive shunt, which, while not affecting the normal operation of the relay, carries the condenser kick around it.

A NEW WALL SET.

A fourth patent of the issue under consideration is that granted to H. F. Farwell, of Chicago, for a design of wall set in which none of the circuits are carried through hinges. In fact, Mr. Farwell dispenses with hinges altogether, mounting all his apparatus within a box, the bottom of which forms the backboard. The base of the transmitter is provided with a collar at the plane of the box cover, this collar being of slightly larger diameter than the transmitter and

accurately fitting a corresponding hole in the box front. Thus the box cover can be removed over the transmitter and yet no unsightly openings are left, when it is returned to place.

The Kellogg-American Bell Complication.

Mr. Milo G. Kellogg has issued under date of November 2, 1903, a statement to the customers of the Kellogg Switchboard Manufacturing Company concerning the sale of the control of that company during his illness to the Bell Telephone interests. The statement gives an account of all the various stages of the complication that arose through the sale, and of the action that had been taken to reinstall Mr. Kellogg in the former position of ownership and control of the Kellogg Company.

The sale of the Kellogg Company took place in January, 1902, while Mr. Kellogg was absent in California sick and incapable of attending to his affairs or of being consulted about them. In August, 1901, previous to going to California, Mr. Kellogg had given to Mr. De Wolf, vice-president of the Kellogg Company, power of attorney to transact any and all business connected with his personal property. During the following December it became apparent that the Everett-Moore syndicate would not be able to care for paper to the amount of $222,000 which the Kellogg Company had accepted and discounted, and which would be due during the next two months. To meet this situation Mr. De Wolf thought it best to make a sale of Mr. Kellogg's stock, by which the funds needed by the company could be secured and at the same time his estate relieved of the care and responsibility connected with the controlling interest in so large a business.

The sale was made to Mr. Barton, of the Western Electric Company, on January 4, 1901, and Mr. Kellogg states that he was not aware of the transaction until July 4, 1902. A correspondence was at once opened with his attorneys, and on October 1, 1902, Mr. Kellogg returned to Chicago and entered actively into negotiations with the American Bell interest with a view to regaining control of his company. He suggested a readjustment by which there would be divided ownership of the stock with the Bell interest in the minority, or a return to Mr. Kellogg of all his stock which had been sold, at a price which would afford $100,000 profit on the transaction to the purchasers from Mr. De Wolf.

In the correspondence on the subject Mr. Kellogg charged that there was a plan which apparently originated at the time of the purchase and which was carried out by the management of the company and by the representatives of the Bell interest, to conceal the sale of the Kellogg stock from the customers of the company and thereby obtain for the company much valuable business which could not otherwise have been obtained; and that under these misleading appearances business for the company during the last year, amounting to over $1,500,000, had been obtained. His own name having been used in the transaction without his knowledge or consent, he claimed the right to be placed in the position of ownership which has been assigned to him with the public during the last year on fair, reasonable and equitable terms, and he offered to repurchase his stock with an allowance of a profit as above stated.

Another line of argument put forth by Mr. Kellogg is that the greater portion of the product of the Kellogg Company consists of apparatus which is claimed by the Bell Company to infringe its patents, and that the Kellogg Company had given guarantee to all of its customers that in case of suit that company would protect the user, bearing all the expense of litigation. With the Bell Company practically directing the management of the company and participating in the profits from the sales, the purchaser obtains practically a license from the Bell Company to use the apparatus. But the Bell Company has previously given to others than these customers of the Kellogg Company the exclusive right to use its patents in certain territories, and to grant to the customers of the Kellogg Company the right to use apparatus claimed to be covered by Bell patents would put the Bell Company in the position of acting in comprevention to its exclusive rights previously given to its licensees. Moreover, in the sales of the Kellogg Company the transmitters are on the basis of $1.75 and the receivers on the basis of $1.35 or thereabouts, while the Bell Company leases the same instruments to its regular licensees at an annual rental which is greater than the above prices at which the Kellogg Company has been selling them during the last year under conditions which really amount to a license under the Bell patent. Consequently, the regular licensees of the Bell Company would be entitled to object to the rentals they pay on the ground that they are exorbitant.

Another difficulty which Mr. Kellogg says would arise if the facts were known is that the Bell Company would practically show to the world that it places very little value on its patents, and capital which may at the present time possibly be deterred from entering into the competition with the Bell interests on account of the patents will no longer have any fear of them. Still another complication pointed out is that the Kellogg Company, its successors and assigns have guaranteed that its apparatus does not infringe any patents granted and in force and valid, and that should this statement be challenged by suit, the Kellogg Company will, at its own cost and expense, defend such suit and pay any damages which may be assessed by reason of any such alleged infringement, or by loss or damage to a customer's business caused thereby. The Bell Company, after acquiring the Kellogg Company, began several suits against the users of the apparatus of that company, and as the former is now practically the owner of the Kellogg Company, which company had guaranteed to make good all damages which may be assessed against the telephone company for infringement, there can be no real controversy between the Bell Company and a telephone company in respect to the suits, since the two parties to the suit would be in essence identical.

Mr. Kellogg states that he brought up the matters above mentioned among others as reasons why the Bell interest should make a return of the stock to him, and, therefore, relieve itself of the manifest difficulties of the ownership of the stock. Early in the year Mr. Kellogg states that he was informed by counsel that the minority stockholders have a remedy if they invoke the aid of the State in proceedings to prevent the formation of unlawful agreements. He then began to consider the form in which he should make announcement of the transaction publicly, but his attention was called by an officer of the company to the fact that a disclosure at that juncture would jeopardize the whole investments of two of the largest customers of the company, which had been made since the Bell interest had obtained control of the company, as this plan had not been fully completed. Negotiations were then again taken up with the view to return of the Kellogg stock, and again failed. Thereupon, Mr. Kellogg confided to some of the minority stockholders the true condition of affairs and a bill of equity was filed June 1 by some of them, asking for a decree of court which should declare the sale of the Kellogg stock to the Bell interest was an unlawful injury to the rights of the minority stockholders and in restraint of trade, and, therefore, illegal and void. In this suit Mr. Kellogg was made a technical defendant, but later he filed a cross bill to this case and he expresses himself as confident that the final determination will be to reinstate him in his former position of ownership and control of the Kellogg Company. In the cross bill Mr. Kellogg places himself in complete accord with the attitude of the minority stockholders and also sets up new reasons why he should be allowed to repurchase the stock. The attorneys for Mr. Kellogg are John O. Miller and Pliny S. Smith, both of Chicago, those of the minority stockholders being Henry S. Robbins and John O. Miller, the latter acting as advisory counsel.

A World-Wide Magnetic Storm.

A remarkable display of the Aurora Borealis was witnessed in this country during the early hours of October 31, with resultant magnetic disturbances of great intensity. Reports have since been received of corresponding manifestations about the same time in various parts of the world. In New York and Chicago, the interruption of telegraphic service on land was complete, and messages were accepted subject to delay by both the Western Union and the Postal Companies. The telephone systems in some cities also suffered, but as far as can be ascertained, wireless telegraphy was not affected in the least. Submarine cables were, however, much affected. In general nothing like it had been felt since 1888, particularly in Central Europe, including Russia. In Switzerland the effects were marked, and at Geneva even the trolley cars had to stop.

Louis A. Bauer, chief of the terrestrial magnetism division of the Coast and Geodetic Survey, says on the subject: "These magnetic disturbances are indicative of the approach of the period of maximum sun spots. This period in the past has come about every eleven and one-third years. The last period was in 1894. Astronomers

have recently discovered sun spots more fully developed than are expected at this time, and the prevalence of magnetic storms, it seems, would indicate that the period of maximum sun spots is coming sooner than usual or will be more than normal in character. The last magnetic storm noted by our laboratory, situated sixteen miles from Washington and in a region unaffected by electrical currents from street cars or machinery, occurred October 11. It was severe enough to deflect the compass needle nearly an entire degree. The reports of the present magnetic storm indicate that it is much more serious in character, inasmuch as we have never before heard of serious interference with cable and telegraph lines. I would judge that the compass needles on ships at sea have been affected to a much greater degree. We have laboratories in Maryland, Kansas, Alaska, the Hawaiian Islands and Puerto Rico, and their observations of these recent magnetic disturbances show that those points are affected simultaneously. As a rule, the disturbance affects the entire surface of the earth. The Aurora Borealis was observed in the New England States two weeks ago.

In England the Meteorological Office reported a magnetic storm, accompanied by Aurora Borealis, in several parts of Ireland and Scotland. The telegraphic disturbance was one of the most extraordinary on record. Before it had been settled where the disturbances originated, although Siberia was strongly suspected, slight seismic disturbances were reported from the Riviera. Sir Oliver Lodge and Sir Norman Lockyer were interviewed on the matter and agreed in attributing the cause to sun spots and an increase in solar activity, which would also account for the unusual wet season now being experienced.

In Paris the almost complete paralysis of the telegraph system is attracting the attention of numerous scientists, including Camille Flammarion, the astronomer, who attributes it to magnetic disturbances caused by huge sun spots which crossed the center meridian of the sun on October 31. Eugene Antoinadi, formerly a co-worker with M. Flammarion, says the disturbance was due to a magnetic storm caused by a group of sun spots 125,442 miles in length. The largest sun spot according to M. Antoinadi, was 37,260 miles long.

Sir Oliver Lodge, the distinguished electrician, president of the University of Birmingham, said in an interview that there are evident signs of great eruptions going on in the sun. There are very large sun spots now, and surrounding each there are indications that masses of gas, calcium and hydrogen and other vapors have been thrown up and have spread over an area compared with which Europe is a mere speck. This area is several thousand times the size of the spots, although each spot is as big as the earth.

One effect is the emission of electrified particles such as are known in the laboratory as cathode rays, the same kind of rays being among those emitted by radium. These electrical particles, shot out from the sun and traveling at enormous speed, constitute an electric current of considerable strength. If they pass near the earth they are quite likely to induce telegraphic, magnetic and other disturbances. Where they penetrate the earth's atmosphere they give rise to the Aurora Borealis.

CURRENT NEWS AND NOTES.

METRIC SYSTEM.—The New Zealand Parliament has passed a bill empowering the Governor to introduce after January, 1906, the metric system, which is then to become the only system of weights and measures for the country.

TRIP TO NIAGARA.—The Central Railway Club, of New York, proposes to hold its next meeting at the auditorium of the Natural Food Company, Niagara Falls, Friday, November 13, when it will visit various plants in the vicinity. Papers will be read.

NEW GERMAN ATLANTIC CABLE.—The new cable of the German Atlantic Cable Company between Emden and Fayal, Azores, has just been completed. This is the first section of the second cable between Germany and New York City. The section between Fayal and New York will be laid early in 1904. This is virtually a part of the Commercial cable system. The route was shown in these pages when the first cable was laid down.

ITALO-ARGENTINE WIRELESS TELEGRAPHY.—It is announced from Rome that Mr. Marconi will arrive there this week to surpervise the work of erecting an ultra powerful wireless telegraphy station for the purpose of establishing communication between Italy and the Argentine Republic.

TELEPHONE RINGS NOT PREFERRED.—President Wheeler, of the Chicago Telephone Company, has accused Cupid of making trouble for the Chicago telephone service. The only complaint he can make against the girls in the employ of the company, is that they are too good, and as soon as they become good operators they go off and get married. He says that the best operators are Irish-American, as they combine quickness and alertness of hand and mind, which are requisites for a superior "hello girl."

A TELEPHONE EXCHANGE CAPTURED.—Some days ago an intoxicated individual took possession of the telephone exchange at Stafford, Neb., during the absence of the manager, who had left it in charge of a young son. For about two hours and a half things were made interesting over the lines between Stafford and Norfolk, as the man is said to have called for connections with several hundred telephones in the latter place, running up a bill against himself of $22.50 before he could be gotten off the wire.

ANOTHER QUICK AUTO RUN.—Mr. C. L. Edgar's automobile, which made such a quick run, with an Edison storage battery equipment, last week, from Boston to New York, has made the return trip in even better time, the total elapsed time being 48 hours, 30 minutes and the actual running time 22 hours 52 minutes, or a speed of 10.8 miles per hour over a distance of 249½ miles. Messrs. W. G. Bee and H. M. Wilson handled the vehicle on the trip. The vehicle had a Columbia motor outfit, solid tires and 68 cells of battery.

UNDERWRITERS' MEETING.—Mr. C. M. Goddard, secretary of the Underwriters' National Electric Association, advises us that the annual meeting of the electrical committee of this association will be held at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, beginning at 10 A. M., Wednesday, December 2. All parties interested in the National Code will be welcome at these meetings as in the past. Any suggestions for changes in the code should reach Mr. Goddard not later than November 16.

AUTOMOBILE CLUB OF AMERICA.—The annual meeting of the Automobile Club of America will be held at the club house, 753 Fifth Avenue, on Monday, November 16, at 4.30 P. M. The governors, pursuant to the by-laws, have nominated the following ticket to fill the vacancies named: For president, Winthrop E. Scarritt; for first vice-president, Henry Rogers Winthrop; for second vice-president, Harry Payne Whitney; for third vice-president, William K. Vanderbilt, Jr.; for treasurer, Jefferson Seligman. For three governors to serve three years (class of 1906)—Dave H. Morris, Sidney Dillon Ripley, Albert R. Shattuck. For two governors to serve one year (class of 1904)—Harlan W. Whipple, Arthur Iselin. Mr. Shattuck positively declined renomination as president, and is entitled by long, arduous service to be "let out." Mr. Scarritt has been a very active and efficient member of the club for some years.

ELECTRICITY ON THE CANALS.—That interest is not lost in canals is shown by the fact that a very heavy majority has carried the proposal at this week's election to make the Erie Canal big enough for 1,000-ton barges. The present limit is about 250 tons. The total cost is put at about $100,000,000. Such a movement gives renewed importance to the application of electricity to canals, and to such tests as that made at Schenectady last week, when the Wood system was tried on about 2,700 ft. of the Erie Canal opposite the General Electric works, which furnished the current. It is a duplex monorail system on low poles, the motor taking current by trolley pole from a wire above and traveling along the rail, or girder, while a wheel grip, pulling upward, steadies it from the lower side of the rail. By carrying a motor at each side of the cross arms, two motors can pass in opposite directions, and are slightly above the other. The towing device has two motors of 40-hp each, and is said to expend about 60 hp in towing four loaded barges of 250 tons each at 4 miles an hour. The experiments made in the presence of Governor Odell are said to have been quite successful, but detailed data is not obtainable from the promoters of the system. Other experiments on the Erie have been made by Mr. Frank W. Hawley, with motors on the boats and trolley connection to parallel wires on the bank; and by Mr. R. Lamb, whose motor traveled on an aerial flexible cableway.

LIGHTING THE ST. LAWRENCE.—On October 29, for the first time, the ship channel between Montreal and Sorel was illuminated by electricity, making it as navigable as during the day. In the past ships have been compelled to lay to in the river during the night. Early next season the river will be lighted as far as Quebec.

TROLLEY IN PARIS.—It is stated that extensions of the overhead trolley in Paris promise to increase. The demand by the omnibus company for almost a general franchise has been answered by a special committee of the City Council, which in principle draws the line against trolleys entering the center of the city, but concedes permission to come well within the city limits. The Council itself, however, may veto all. One overhead trolley is already in operation in the Rue du Quatre Septembre, near the Opéra. A temporary franchise was obtained, but, as usual in such cases, it will probably remain indefinitely.

ARM AND PIN CONVENTION.—Mr. J. B. Magers, secretary, informs us that the manufacturers of arms, pins and brackets will hold a convention on November 10 at Chattanooga, Tenn. The American Boiler Manufacturers' Association has also arranged to hold its meeting at the same time, for mutual benefit and convenience, and it is requested that in securing transportation the members of the former association will, in buying tickets for the latter, report to its secretary, who will sign all the certificates. Upon receipt of the fee of $1, members will receive blue prints of the shapes and dimensions, etc., adopted by the association for the standard arm, pin and bracket.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The nominations for officers of this Society for the coming year, made by the Nominating Committee, are as follows: For president, Mr. Ambrose Swasey, of Cleveland, Ohio. For vice-presidents—Prof. D. S. Jacobus, of Hoboken, N. J.; Mr. M. L. Holman, of St. Louis, Mo.; Mr. William J. Keep, of Detroit, Mich. For managers—Mr. George I. Rockwood, of Worcester, Mass.; Mr. John W. Lieb, Jr., of New York City; Mr. Asa M. Mattice, of Pittsburg, Pa. For treasurer, Mr. William H. Wiley, of New York City. At the December meeting, the headquarters of the Society will be, as usual, at the Society House, 12 West Thirty-first Street, where the opening session will occur on Tuesday evening, December 1, at 9 P. M. The president, Mr. James M. Dodge, will deliver the annual address, the subject being "The Value of an Engineering Education to a Young Man." The second session will occur on Wednesday morning, at the hall of the Mendelssohn Glee Club, 113 West Fortieth Street. This will be the business session of the convention and professional papers will also be presented. Following this luncheon will be served at the Society House, and the afternoon will be spent in making excursions to various power stations and points of interest. The evening of this day has been left free for the members to make their own engagements. The third session will take place in the Carnegie Laboratory of Stevens Institute on Thursday morning at 10 o'clock. Luncheon will be served at the Institute, and will be followed by visits to various points of interest in and about the grounds. The usual reception for guests and friends will be at Sherry's on Thursday evening, at 9 o'clock, and will be followed by dancing and supper. The closing session will be at the Society House on Friday morning, December 4, at 10 o'clock.

WIRELESS TELEGRAPH PATENTS.—The interest in wireless telegraphy among inventors is indicated by the flood of patents on that subject issuing from the Patent Office. Among the latest of these are two issued to Prof. R. A Fessenden, one of which is an extension of a previously patented system by the same inventor involving the use of one or more reactance circuits between the antennæ and the receiving and sending circuits, the object of which is to obtain sharp tuning and selectivity. This method will be recognized as similar to that of Stone, recently described in these columns. The second patent relates to means for neutralizing in a wireless telegraph receiving circuit disturbing impulses or waves of a frequency different from that it is desired to receive. This consists in the use of two receiving conductors which are tuned to different periodicities by suitable means. When an electric impulse is received by the two conductors, the first few oscillations of the series of waves will generate nearly the same potential at the ends of the coherer or translating device in series therewith; but if the oscillations persist and their periodicity agrees with that to which either of the receiving conductors is tuned, the potential at one end of the coherer will rise higher than that of the other and the receiver will be actuated. If, however, the periodicity of the impulse does not agree with that to which either receiving conductor is tuned, there will be no cumulative rise in the potential at one end of the receiving device, and if the periodicity of the impulse be sufficiently different from the periodicities to which the receiving conductors are tuned there will be no appreciable rise at one end above that of the opposite end. Another recent patent relates to a new form of detector, the patentees being L. H. Walter and Prof. J. A. Ewing, of Cambridge, England. This is of the hysteresis type, and consists of hard steel, fine, insulated wire on a vertical bobbin carried on pivots and controlled by a torsion spring, the whole being contained in a vessel containing petroleum or other insulating fluid for damping the vibrations. The winding of the bobbin is in the receiving circuit. A prolongation of the axis of the bobbin carries an indicator, which may be a mirror or a siphon recorder. Surrounding this arrangement is a magnetic field construction which is caused to revolve by an electric motor. When the magnet is set to revolve, the bobbin tends to follow it in consequence of the energy expended in reversing the magnetism of the iron or steel winding which it carries, and this tendency is met by applying a suitable restoring moment by means of the spring torsion. Then when electric oscillations pass through the wire on the bobbin the deflection of the bobbin is increased, which effect is shown by a sudden deflection in the direction in which the magnet revolves. The deflection persists while the electric oscillations continue, and the bobbin returns when the oscillations cease. Thus long and short periods of oscillation are exhibited by long and short periods of augmented deflection. Still another patent on detectors relates to mechanical details of the ordinary filings coherer, including a mounting whereby a coherer may be quickly replaced without disconnecting circuit wires, the patentee of this improvement being Thomas E. Clark.

LETTERS TO THE EDITORS.

Three-Phase Measurements.

To the Editors of Electrical World and Engineer:

SIRS:—Since from my own experience I believe any one having to do with unbalanced three-phase circuits appreciates all information he can get on the subject, I may call the attention of such of your readers as are interested in the matter presented in Mr. Jeannin's article on "Three-Phase Measurements" in your issue of October 10, to the application which I contributed to your columns on January 10, 1903, of a similar method to the calculation of the apparent kilowatts in any three-phase circuit, balanced or unbalanced, inductive or non-inductive. I would also call attention to an accurate geometric method of construction and trigonometrical method of calculation as given by me on page 449 of your issue of March 14, 1903.

SAO PAULO, BRAZIL. L. L. PERRY.

To the Editors of Electrical World and Engineer:

SIRS:—The elaborate method for the determination of the relative phase positions of the several currents in a three-phase circuit operating on an unbalanced load by Mr. F. Hardie Jeannin, as set forth in your issue of October 10, furnishes a ready means for ascertaining from the readings of the three values of amperes and three of volts the apparent power in the circuit, and also the real watts transmitted when the load is strictly non-inductive. It is well, however, to note the fact that, for commercial loads, the method gives no indication of the true power. In the expression for power in a three-phase circuit,

$$W = \sqrt{3} EI \cos \phi,$$

the quantity $\cos \phi$ has been omitted. The inability of an ammeter-voltmeter method for determining the true power will be appreciated if one considers that with equal e.m.f.'s per delta of E, and equal currents per lead of I, the real power may have any value from *nil* to $\sqrt{3}\,EI$.

It is well also to call attention to the fact that in three-phase problems only currents of the circuit frequency can be represented in a single plane, as are the line currents to form the sides of a triangle by their values and relative phase positions. Any current at a different frequency must be represented by a vector in quadrature, with any vector representing any quantity at the fundamental frequency. To fulfill this condition, its location must be at right-angles to the plane containing the fundamental triangle. A superposed asynchronous current has no effect upon the watts transmitted, but it increases the value of the circuit current and leaves in doubt the value to be assigned to the apparent power. The true power, however, is properly recorded by two wattmeters as ordinarily introduced into the circuit.

The existence of current at a frequency different from the fundamental of the circuit becomes of considerable importance with any live load, as, for example, with asynchronous, and especially with synchronous motors and converters. Any variation of the e.m.f. wave form of the motor from that of the circuit causes to flow current at an harmonic frequency, and with motors running light, this quadrature, space component of current is frequently of a value sufficient to overshadow all other currents in the circuit.

ITHACA, N. Y. A. S. MCALLISTER.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Compounding of Alternating-Current Generators.—MEYER.—The author discusses the compensation and compounding of alternating-current generators, in order to arrive at some conclusion in regard to their commercial superiority over the standard revolving field type. He bases his remarks on an article by Heyland, noted in the Digest of October 24. He considers the first cost, the cost of operation, the cost of maintenance and the cost of reserves of both types of machines. As far as first cost is concerned, and especially the claim that a Heyland synchronous generator ought to be cheaper, since a larger armature reaction is permissible than with a normal type generator of close regulation, the author contends that the diameter in both types must be the same, as that is determined chiefly by the number of poles. A saving can, therefore, be obtained only in the width of the machine; but "while the cost of an alternating-current generator is reduced approximately as the square of the reduction in diameter, it will only be reduced at about one-half the reduction in width," and, therefore, the gain in this direction cannot be very great. A copper strip winding which in most cases can be put on a standard machine, is also more economical and cheaper than a multiple wire winding with its number of connections to the commutator. As regards the cost of the cross-connected commutator as against the standard exciter, he concludes that for ordinary high-speed machines there will not be much difference, as the material is a much less important item than the labor, especially as the exciter is mostly a modified standard machine, while the self-exciting commutator has to be made up specially adapted to each kind of generator. For slow-speed machines the conditions will be much more unfavorable to the Heyland type, as the commutator, owing to the number of poles, will take enormous dimensions. As according to Heyland 6 or even 12 segments are preferable per pole, a 64-pole machine would have to have 384 or 768 segments respectively. For generators with more than 20 poles, the cost of the commutator and its connections should be considerably higher than that of a corresponding standard exciter. The question of efficiency is discussed under the heading of the cost of operation, and with the assumption that a gain in efficiency is possible, due to the smaller amount of iron in the stator, and the reduced copper section required for excitation. This ought, however, to be more than set off by the larger brush contact and the friction losses in the commutator, and by the losses incurred through compounding and in the accessories. The cost of maintenance should be about the same in both cases, though in large, slow-speed machines, the advantage is decidedly on the side of the standard machine, owing to the wear of the large commutator. The cost of reserves is considered by the author to be a most important item, which turns the scales altogether in favor of the standard generator. The commutator and all the accessories form an inherent part of the Heyland machine and in case of a break-down anywhere the whole generator has to be shut down. Therefore, a plant with these generators would seem to require in all cases a reserve generating set with all accessories, where a spare or amply proportioned exciter would do in the case of the standard machines. In conclusion, the author states that the above statements are based on the data at present available and may be somewhat modified if further particulars obtained in actual operation of Heyland machines are given; but as the main objections are not affected thereby, their usefulness will always remain limited.—Lond. *Elec.*, October 16.

Iron Loss in Dynamos.—PRESS.—The author investigates mathematically the iron loss in dynamos, in order to find an explanation for the fact that such loss is about two and a half times as much as it is in transformers, for the same maximum density. In the case of direct-current machines, he comes to the conclusion that the great difference between these losses can be explained in major part by taking into account the slope of the flux distribution wave, the ratio of transformer to dynamo losses being actually 1 : 2.5. By the method of slopes the losses become 1 : 1.9, leaving 0.6 out of 2.5 to be accounted for by rotating hysteresis, end casting effect, iron loss effect of teeth under pole shoe (which for a narrow air-gap is comparatively large for a great number of teeth), by circulating current and by losses unaccounted for and due to commutation. He concludes further that the so-called full-load increment in iron loss can be in a measure accounted for by the skewing of flux due to cross magnetization. For the same volume of flux, skewing may increase the eddy loss to almost any value, and an eddy loss increase from three to four times may be looked for. He also concludes that the ideal distribution curve is a parabola degenerating into a flat top, with parabolic sides for a minimum total iron loss, and that for a given pole pitch there should be less and less flat top the greater the periodicity, i. e., the revolutions. In the second part of the article he considers the case of alternators, and comes to the conclusion that with machines of low frequency, where the coefficient of hysteresis is more important than the eddy current coefficient, a flat top wave should be aimed at. A formula is given for the flux distribution curve. He also calls attention to the fact that the pole pitch factor is smaller in alternators than in direct-current machines, and the flux density is also smaller; hence, the incremental iron loss when the machine takes on load should be less, since the skewing plays a less important rôle. This would explain the fact that whatever additional loss is observed in alternators, is usually quite small. —Lond. *Elec.*, October 16.

Alternators in Parallel.—ROSENBERG.—He discusses at considerable length the influence of the damping with alternators working in parallel. He uses the word "Reaktionsverhaetniss," or reaction-relation, to define the ratio between the synchronizing moment and the initial pendulum moment, which gives an insight into the reaction of the alternator on the prime-mover. The expression, reaction-relation = 1, signifies, then, complete equality between the forced and the free oscillations, i. e., complete resonance. The author concludes from his investigations that there is a wide field for the application of the damping, the limits of which are sharply defined by the reaction-relation. If the latter is between 0 and ½, the damping has a harmful effect, whereas when it exceeds the value of ½, the damping is beneficial. It has the greatest value for a reaction-relation, which comes near to unity. To be on the safe side, a machine should be equipped with such large fly-wheel masses that the calculated oscillations are within allowable limits, and the factor of increment is small for all oscillations which come into consideration, and in that case damping can be dispensed with. In cases, however, where other considerations demand as low as possible fly-wheel weight, or where, in machines already built, the reaction-relation is large, due to the non-consideration of these calculations,

the damping is an effective means for relief or even cure.—*Elek. Zeit.*, October 15.

Variable-Speed Motors.—Courtier.—A paper read before the International Society of Electricians in Paris. The author gives the results of some recent experiments with a Couffinhel motor, the speed of which is varied by changing the air-gap. The mechanism by which the change of the air-gap is effected is briefly mentioned. The motor with which the experiments were carried out was a bipolar machine of 28 amp. at 220 volts. The measurements were made with half the normal current, or 14.5 amp., and the full normal current of 25 amp. The air-gap was varied between 3 and 48 mm., with speeds ranging between 465 and 1,809 revolutions, respectively. The efficiency for half current was 83 per cent. for the slow-speed and 79 per cent. for the high-speed. With full normal current and nearly the same speeds the efficiency was 85.5 per cent. for the low and 80 per cent. for the high-speed. A table is also given for the hysteresis and the eddy current losses for the various speeds.—*L'Eclairage Electrique*, October 10.

REFERENCE.

Armature Reaction of Alternators.—Guilbert.—A mathematical article in which the author calculates the direct and the transverse magnetomotive force for ordinary alternating and polyphase currents.—*La Revue Technique*, September 25, October 10.

Lights and Lighting.

Intense Arc Light and Mercury Vapor Light.—Hospitalier.—A paper read before the International Society of Electricians in Paris. The author discusses briefly the "intense" (Bremer) arc light lamps, stating that in experiments made by Janet at the Laboratoire Central d'Electricité, an ordinary arc light without a globe was found to give 16.8 lumens per watt, while a Bremer lamp gave 32.6 lumens per watt. He refers briefly to some unpublished work of Blondel with tri-zone carbons, which, according to him, have made it possible to obtain arcs of only 3 amp., which produced a luminous flux of 45 lumens per watt, and arcs of 9 amp., which produced 77 lumens per watt, or more than four times the amount of an ordinary arc absorbing the same power. He then discussed the Cooper Hewitt lamp. (A lumen is the flux of light of one [hefner] candle through a solid angle. One spherical [English] candle equals 14.28 lumens. —*Comp.*)—*L'Eclairage Electrique*, October 10.

REFERENCE.

Electric Lighthouses.—König.—A review of the advantages of the electric lighting of lighthouses, as compared with oil and acetylene.—*Elek. Anz.*, September 20.

Power.

Electric Pumping Plant.—An illustrated description of a recent installation for the electrical operation of a large mine drainage pump. The generating station comprises a large 840-hp steam engine, driving a three-phase fly-wheel magnet alternator with 30 poles, which generates 22.5 cycles current at 2,000 volts. The exciter is driven by a separate vertical steam engine. A smaller 150-hp engine drives by belt a three-phase generator. The pump is designed to raise 5 cu. m. of water to a height of 400 metres. The motor, which is coupled directly to it, is of the three-phase induction type, and has a normal output of 570 hp at 78 r.p.m., and a starting torque 20 per cent. greater than the normal torque, with full load current. The diameter of the rotor is 3 metres and the air-gap measures 2 mm. The winding of the stator consists of 162 coils embedded in 324 grooves and insulated with micanite tubes. The weight of the whole machine is 28 metric tons, of which 9 are sheet iron and 1.4 copper. At normal load the motor absorbs about 170 amp. in each phase, with a power factor of 82 per cent. and an efficiency of 92 per cent., the slip being 2.7 per cent. The maximum torque is twice the normal torque.—Lond. *Elec. Rev.*, October 16.

French Aluminum Manufacturing Power Plant.—Perkins.—An illustrated description of the plant of the Société Electrometallurgique Française at La Pras, Savoie. In the generator room of the power house, there are more than 30 electrical machines of a capacity of nearly 15,000 hp. The first generators installed were of the vertical type, directly coupled to vertical turbines. The latter machines are of the horizontal type, direct-connected to horizontal turbines. An alternator is also illustrated, which is stated to serve for the production of steel in the electric furnace. It is a monophase 500-hp machine, running at 110 volts and 33 periods, and supplies a current of 3,750 amp. at 250 r.p.m. The field poles revolve within the armature, which is stationary. The field has 16 poles, the winding of each pole consisting of a conductor of a cross-section of 6.5×6.6 mm. The armature winding consists of 16 parallel circuits connected to two metallic rings, the conductors consisting of copper bars 2.2 mm. thick and 42 mm. wide. The machine delivers a current of either 120 or 65 volts, as desired.—*Electricity*, October 14.

Small Electric Station Driven by Wind Power.—Lacour.—An abstract of a paper read before the Technical Congress in Copenhagen. A description is given of a small plant in Askov, Denmark, where a wind motor is used for furnishing current. The greatest difficulty was encountered in getting a suitable speed regulation for the dynamo, as it could not be coupled directly to the wind motor on account of the variations of speed of the latter. This has been overcome by adopting two different regulations, one by a mechanical arrangement, which acts when the speed of the wind motor is too great, and another by an electrical arrangement, if the speed is too low. The arrangement is briefly and diagrammatically illustrated. The current is used for the charging of a storage battery. The station furnishes light and power to the inhabitants of several rural communities. The normal current is 50 amp., and the voltage of the circuit 2×110. It is stated that the station has worked very satisfactorily and has made good profits.—*Elek. Anz.*, October 15; from *Teknik Tidskrift*, Stockholm.

REFERENCES.

Motor-Driven Vertical Milling Machine.—An illustrated description of a recent construction.—*Am. Machinist*, October 22.

Air Compressors Driven by Electricity.—The conclusion of the article previously noted in the Digest. A number of constructions are described and illustrated.—*Glueckauf*, October 10.

Traction.

Multiple-Unit Train Control.—An illustrated description of the Siemens-Schuckert multiple-unit train control, which has recently been employed on the Overhead and Underground Railway of Berlin. The actual working of the controllers is accomplished by a pneumatic system, the air valves being electrically operated by a low-voltage current. There are two separate drum pattern controllers, viz., a reversing controller and a speed controller, both built on standard lines. The last-named controller has two chief stops, one for the series position of the motors and the other for the parallel position; but the arrangement is such that the drum may be made to stop in any intermediate position. To insure the prompt working of the switching-off arrangement in the case of a train breaking in two, the current which operates the valve mechanism is left continuously flowing during the time the train is running. If this control current circuit is broken for any reason, the motors are switched off. The system is explained at some length.—Lond. *Elec.*, October 16.

REFERENCE.

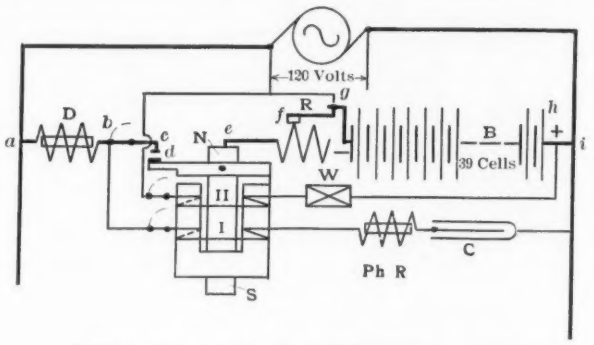
Magnetic Method for the Study of Railway Axles.—Sandaran.—An abstract of a paper in which the author outlines a method for the study of the changes in molecular conditions, which the axles of locomotives and railroad cars undergo when in service, on account of the continuous vibrations to which they are exposed. The method is based upon measuring the magnetic permeability and recording the gradual changes of the latter. The arrangement which the author uses is illustrated and his method of conducting the experiment is described in detail.—*L'Eclairage Electrique*, October 17; from *La Energia Electrica*, Madrid, July, 1903.

Installations, Systems and Appliances.

Three-Phase Switch Gear.—Eborall.—The continuation of his illustrated serial, previously mentioned in the Digest. In this issue he deals at length with light-pressure oil switches and their auxiliary attachments. In place of the employment of quick-acting fuses on the machine and feeder panels of the power station and sub-station switchboards, he recommends the following arrangement of the protective devices for standard cases: 1. Automatic non-overload switches with reverse-current attachments on the generator panels; they will take care of the system should an alternator fail through losing its excitation or through a coil giving out, or should a faulty synchronizing or measuring transformer fail to be protected by its fuses. There will be no interruption in the supply.

the remaining generators sharing the extra load until a spare unit can be got in. 2. Automatic overload switches with time attachments on the feeder panels, which will cut out any faulty feeder (or one with a persistent abnormal overload) at the station end. 3. Automatic non-overload switches with reverse-current and time attachments on the feeder panels of the sub-station board, these switches being inserted between the feeders and the high-pressure bus-bars. Their object is, in the first place, to prevent the fault in a defective feeder (disconnected at the station end by arrangement 2) being supplied through the healthy feeders from the power station or with back current from the synchronous machinery in the sub-station and also to prevent, in the second place, a fault which might occur in the power station being supplied with current from motored synchronous machinery in the sub-station, back through the feeders. 4. Automatic overload switches with time attachments on the machine panels of the sub-station switchboards; that is to say, in circuit with the synchronous motors or transformers (supplying the rotaries), as the case may be. These circuit-breakers take care of the individual converting units. The overload time circuit-breakers referred to in 4 should be set for quicker operation than those in 2, and the reverse-current time circuit-breakers in 3 for quicker operation than the overload time circuit-breakers in 2. For the case in which feeders from the distant power station pass through a nearer sub-station on their way to others more remote, the above arrangement must be extended by providing overload time circuit-breakers on the outgoing feeder panels in the sub-station. The author then discusses the objections against such an arrangement involving much complicated additional apparatus at considerable additional expenditure and gives his reasons for thinking that the additional expense is not so large as it might seem at first sight. He then discusses the question of what would happen if one of the reverse-current circuit-breakers on the generator panels of the power station switchboard should take fire. He comes to the conclusion that such a contingency is very remote indeed, and on account of the smallness of the risk he would not provide for it as a general rule. For exceptional cases he would prefer to make these panel section switches in the form of hand-operated oil switches.—Lond. *Eng'ing*, October 9.

Direct Current from Alternating-Current Circuits.—STERZEL.—The author gives the results of investigations conducted with a rectifier constructed according to Koch's system, which was described in the Digest of November 9, 1901. The apparatus was used for about a year and a half to charge a battery of storage cells of 20 amp. charging current, from a three-phase, 50-cycle current at 120 volts. The apparatus is illustrated diagrammatically in the adjoining figure.



DIRECT CURRENT FROM ALTERNATING CIRCUITS.

The main circuit consists of an oscillating relay armature, a choking coil, *D*, of moderate reactance, an ordinary regulating rheostat, *R*, and the storage cells, *B*. The shunt circuit, *I*, consists of two field coils, a condenser, *C*, for obtaining a lead of the current, and a variable self-induction coil, *Ph R*, for the exact regulation of the current phase. The oscillating armature closes the contact with the utmost precision at times, when no power is transmitted; that is, at the moment where the charging current and the battery voltage have the same value. A second shunt circuit, *II*, consisting of a second winding on the field coils and a rheostat, regulates automatically the time of contact, as in the charging of the cells the time for which an excess of the alternating voltage over the alternating voltage obtains, gradually becomes shorter. If a counter e.m.f. (storage battery) is not present in the circuit, the apparatus takes complete alternation and circuit *II* and the reactance coil, *D*, can be dispensed with. The author determined the completeness of the utilization of one alternator, which he finds to be within 3 per cent. of the theoretical when the battery was replaced by an ohmic resistance. Experiments were also conducted with various amperages for charging the battery, from which he calculates the factor of completeness of current utilization. The electrolytic direct-current equivalent was also determined. In conclusion he calculates an example for a rectifying arrangement, in order to determine the necessary resistances which have to be introduced into the circuit.—*Elek. Zeit.*, October 8.

REFERENCES.

Coventry (England) Electricity Works.—An illustrated description of recent extensions, consisting of two 600-kw alternators. They are of the standard revolving field type, running at 2,000 volts, 50 cycles, and are direct-coupled to triple-expansion engines of 125 r.p.m. The revolving field is carried on a cast-steel spider. The exciter is a shunt-wound dynamo mounted directly on an extension of the alternator shaft. The construction of the machines is briefly described.—Lond. *Elec. Rev.*, October 16.

Synchronizing Devices.—DAVIES.—An article, illustrated by diagrams, giving a review of the development of the methods of synchronization and a description of those in use.—Lond. *Elec. Eng.*, October 2.

Electrical Station Practice.—RADCLIFFE.—The continuation of his long illustrated serial, previously mentioned in the Digest. The plan of the building is discussed and the interior arrangement of a station dealt with at length. The installation of machines and apparatus is then taken up.—*Electricity*, September 30, October 7, 14, 21.

WIRES, WIRING AND CONDUITS.

REFERENCE.

Calculation of Networks of Conductors.—BUSSET-SCHILLER.—An article illustrated by several diagrams in which the author gives an improvement of his graphical method for finding the most favorable position of the junction points for mains and feeders, which was referred to in the Digest of October 3.—*L'Ind. Electrique*, September 25.

ELECTRO-PHYSICS AND MAGNETISM.

Discharging Power of Ultra-Violet Light.—LADENBURG.—An abstract of an article in which the author draws attention to a notable difference between the photoelectric effects observed by Elster and Geitel, and that observed by Lenard in an absolute vacuum. The former, working with ordinary light, found a decisive influence on the direction of the plane of polarization. The latter found that the effect depends solely on the amount of light, and not upon its direction of vibration. The author suggests that this may be due to the fact that the ultra-violet light penetrates below the surface, whereas the ordinary light does not. Experiment shows that this supposition is correct. Mirrors of burnt-in platinum were used, upon which nickel mirrors of various thicknesses were deposited electrolytically. He found that the so-called fatigue of the mirrors is due to some change in the condition of the surface produced by the light. The maximum current is obtained with the brightest polish. The series of metals arranged in order of current strength begins with platinum and ends with nickel, but shows no connection with other physical properties. The current depends simply upon the amount of incident ultra-violet light, and not upon its angle of incidence or polarization. In the case of nickel, the distance to which light penetrates into the metal is about 8 wave lengths.—Lond. *Elec.*, October 9.

Influence of the Field upon the Magnetic Susceptibility of Solutions.—HEYDWEILLER.—A short abstract, giving the results of his investigation of the above subject. He finds that within small variations of field intensity the change in the susceptibility of solutions of iron and manganese salts is inappreciable, but that when the fields range from 0.1 to 40,000 C.G.S. units, variations are distinctly traceable. In ferric chloride they are slight, in ferrous and manganous chloride they are somewhat greater, and in the sulphates the variations attain as much as 30 or 40 per cent. As regards the theory of molecular magnets, it must be concluded that complex molecules are formed in these salts.—Lond. *Elec.*, October 9; abstracted from *Annal. der Phys.*, No. 11, 1903.

REFERENCES.

Magnetism.—MAURAIN.—A very long article, illustrated by diagrams, containing a review of recent progress in the study of mag-

netism. The author discusses the general magnetic properties of nearly pure iron, steel, cast iron, etc., the magnetization curves and the influence of other substances than iron and carbon. He also deals at length with the influence of the speed of variation of the magnetic fields and the results obtained by a number of investigators. The third part of the article is devoted to the discussion of the variation of the magnetic properties with the temperature.—*L'Eclairage Electrique*, October 3, 10.

Magnetic Properties of Iron Containing Carbon.—Maurain.—The author discusses the relation between the constitution of the varieties of iron which contains carbon, and their magnetic properties.—*L'Eclairage Electrique*, October 17.

Electro-Chemistry and Batteries.

Generation of Acetylene.—Morehead.—An article in which the chemical questions involved in the generation of acetylene from calcium carbide and water are discussed, with special reference to the methods by which the possible sources of danger are eliminated in modern acetylene generators. So far as the toxic properties of the gas are concerned there is practically no danger. The three important points are danger from overheating, from excessive after-generation, and from an explosion of a mixture of the gas and air. Overheating is due to the heat developed in the reaction between calcium carbide and water; the production of this heat cannot be avoided in any way, so that the first consideration in the design of the generator must be to get rid of this heat. This may be done in two different ways: first, by dissipation into the surrounding air, and second, by absorption in water; dry machines used for bicycle or automobile lamps, etc., depend upon the first principle; wet machines, upon the second. All charged machines belong to the latter class. To counteract the danger from an excessive pressure due to after-generation, the present generators retain their gas by means of water seals, which would "blow" at a few pounds and relieve the pressure. The author considers that a true explosion like that of gunpowder or of glycerine is a dissocfation, and that the explosion of a mixture of acetylene and air is really a very rapid and very violent combustion, burning; that is, a combination of carbon with oxygen. The maximum explosive effect is obtained by mixing acetylene gas with 12.5 times its volume of air; the explosion requires that the mixture be ignited. Through gross ignorance or carelessness an acetylene generator can be made to fill a basement with gas just as it can by only ordinary care be made to supply a system of burners. A basement full of air and gas, water gas, coal gas, natural gas, or acetylene gas, is harmless unless ignited.—*Electrochem. Ind.*, October.

Precipitation of Gold from Cyanide Solutions.—Caldecott and Johnson.—A paper in which the authors discuss the reactions involved in the precipitation of gold from cyanide solutions, either by means of zinc shavings or by the electric current. They agree that the view based on the ionic theory, according to which potassium ions are primarily precipitated and afterwards react with the double salt in solution with the result of a secondary deposition of gold, may be the more correct one; but they think that as a working hypothesis, it is better to assume that the precipitation of gold is due to nascent hydrogen. The precipitating efficiency of chemically pure zinc is practically zero, as the action is that of a zinc couple; the function of the less positive metal in the couple is thought to afford innumerable points of the rough surface for the liberation of hydrogen. The great barrier to continuously effective precipitation is the lack of contact between the precipitating surface and the solution, and, owing to the readiness with which the surface becomes coated in various ways, it is necessary to employ enormous areas to insure good results. A most efficient aid to zinc precipitation would be the discovery of some solvent for zinc hydrate which will not interfere with the cyanide.—*Electrochem. Ind.*, October, 1903.

Electrolytic Formation of Perchlorates.—Oechsli.—A very long article, in which the author gives the results of his studies on the above subject. In order to determine the conditions for the formation of perchlorate, he conducted electrolyses of the chlorate in neutral acid and alkaline solution, with variable current densities, and with smooth and platinized anodes. His conclusion is that his results agree with the idea that the electrolytic formation of perchlorate is brought about by the spontaneous decomposition of discharged ClO_3 ions into ClO_4 and ClO_2, while the chlorous acid, which appears in this connection, is oxidized by the current to chloric acid.—*Zeit. f. Electrochem.*, October 8.

Reference.

International Congress for Applied Chemistry.—Danneel and Clement.—A continuation of their congress report, with abstracts of the following papers: Lebeau, on the composition of electro-metallurgic products containing silicon; Coehn, on the specific action of metals in electrolytic reduction and oxidation; Solvay, on the application of a formula of gravitation to the process of diffusion; Goldschmidt, on the kinetics of the reaction of the reduction of metals; Elbs, on the electrochemical methods for the preparation of organic chemicals; Buchner, on the electrochemical methods in technical organic chemistry.—*Electrochem. Ind.*, October, 1903.

Units, Measurements and Instruments.

Transformers for Measuring Instruments.—Punga.—An article in which the author considers the various points to be taken into consideration of transformers to be used in connection with measuring instruments for measuring large currents, especially when the transformer is to be used for more than one frequency and in connection with more than one instrument. The construction of a transformer intended for one primary turn only is illustrated. It is stated that secondary currents of 1 to 5 amp. will be found most useful, the number of ampere-turns depending entirely upon the purpose the transformer has to serve. If standard transformers have to be designed, the author suggests the adoption of three different sizes, viz.: a cheap one for use in connection with switchboard instruments, up to about 500 amp., and two larger ones with 1,500 and 4,000 amp., respectively, on the secondary winding, to be used for wattmeters, power factor indicators, integrating meters, etc. The author then investigates mathematically whether the ratio between the primary and secondary currents is constant at varying loads, and if not, how much it varies. He deduces a formula, from which he calculates a table for the ratio at different loads. He finds that between 20 per cent. full load and 30 per cent. overload the ratio does not vary more than 3.5 per cent., which he considers sufficiently accurate for most practical purposes. He then considers the above ratio for different frequencies with the help of a diagram, from which he deduces the following means for reducing the influence of the frequency on the ratio, viz.: 1. By using iron of high permeability; 2, by making the magnetic path through the air as well as through the iron as short as possible; 3, by making the total resistance of the secondary circuit as small as possible, and 4, by making the self-induction of the secondary circuit as high as possible. The fourth means, however, he considers doubtful, because the magnetizing ampere-turns are increased nearly in the same ratio, thus altering the ratio between the primary and secondary currents in relation to different loads. In conclusion, he gives some data of a transformer employed with a Thompson recording wattmeter, with 125 amp. in the primary and 25 amp. in the secondary.—Lond. *Elec.*, October 9.

Ballistic Galvanometers.—Powell.—A paper read before the British Association on some points in the design and working of ballistic galvanometers. The author first calculates a formula for the damping effect, and in order that the motion of the coil may be effectively stopped by short-circuiting, its resistance must not be greater than the value obtained by the equation. When a deflection is being read, however, in order to render the damping term inappreciable, the total resistance of the circuit must be considerably greater than this value. In a special case, a galvanometer was calculated and constructed, and was found to have a much higher period and much lower sensibility, than it had been designed for. The cause was found to be that the copper wire used for the construction of the coil was magnetic, and that this magnetic control was very large in comparison with the feeble control of the strip. To overcome the difficulty, it was tried to obtain non-magnetic wires, but the best results were obtained by depositing electrolytic copper on a very fine wire. This was, however, brittle and an attempt at rolling and annealing it resulted in making it magnetic. The method finally adopted consisted in using a very narrow coil and making the field of the permanent magnet as uniform as possible by means of pole-pieces. In order to increase the moment of inertia of the system a light copper disc was attached rigidly to the coil by a light bone rod. This arrangement gave satisfaction as regards sensibility and periodic time, but did not damp well when short-circuited. This difficulty was overcome by placing below the copper disc a small electromagnet, which, when excited, quickly brought the disc to rest by reason of the eddy currents induced in it. In conclusion the method of calibrating the instrument is briefly outlined.—Lond. *Elec.*, October 9.

REFERENCE.

Measurement of Power in Alternating-Current Circuits.—BALLARD.—A didactic article, reviewing the methods for carrying out the measurements.—*Engineer,* October 1.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraph Apparatus.—An illustrated article describing the application of the Lodge-Muirhead system of telegraphy to a portable apparatus for military purposes. The aerial system is only 46 ft. in height, and is constructed on the "roof" principle, in the shape of an upright pyramid. The lower capacity area is not formed by an ordinary earth, but by a copper netting and several copper plates. The sending and receiving circuits are diagrammatically illustrated. An open circuit is employed, the aerial on the one side and the capacity, adjustable inductance and wire netting on the other, being connected directly to the spark knobs of the secondary of the induction coil in the case of the transmitting circuit. For receiving, the aerial is connected to the primary of the "jigger," whose other terminal goes straight to the wire netting, etc., and in this case an adjustment is possible by changing the "jigger." The secondary circuit of the receiving station consists of a Lodge revolving disc coherer and a syphon recorder, current being supplied from two storage cells through a potentiometer. The system recorder is bridged by an adjustable condenser.—Lond. *Elec.,* October 16.

Electric Switch and Signal System.—An illustrated description of the system adopted by the North Eastern (England) Railway Company in a recent installation. With the exception of the mechanical interlocking of the switches and signals, all operations are performed by electric power. The levers in the signal cabin are used only to operate the electric switches controlling the motor and signal apparatus, the physical labor on the part of the operator is, therefore, much less than with the ordinary arrangement. The motors for operating the switches are of 2½ hp. Current is supplied at 200 volts from the railroad company's power station.—Lond. *Elec. Eng.,* October 16.

REFERENCES.

The Present State of Wireless Telegraphy.—TISSOT.—A long historical review of the development of wireless telegraphy and its present condition.—*Rev. gen. des Sciences,* October 15.

Automatic Signal System.—An article giving an illustrated description of the Harrison electric signal system for electric roads.—Lond. *Elec. Eng.,* October 16.

Telephone Exchange.—An illustrated description of the large automatic exchange of the Home Telephone Company, of Dayton, Ohio.—*Elec. Rev.,* October 24.

MISCELLANEOUS.

Production and Consumption of the Most Important Metals.—An abstract of statistics collected by the Metallgesellschaft and the Metallurgical Gesellschaft, of Frankfort-on-the-Main, Germany, for 1902 and the seven first months of the current year.—*Glueckauf,* October 10.

Electric Welding Apparatus.—REYVAL.—An illustrated description of several types of electric welders constructed by the Société Française Thomson-Houston and an enumeration of the applications of the electric method to the welding of various shapes.—*L'Eclairage Electrique,* October 17.

New Books.

INDUKTIONSMOTOREN. Ein Kompendium für Studirende und Ingenieure. By B. A. Behrend. Translated by Dr. Paul Berkitz, with notes by Prof. W. Kubler-Dresden. Berlin: M. Krayn. 182 pages, 107 illustrations and 10 plates. Price, 11.50 marks.

The German translation of Behrend's book on the induction motor has been enlarged by several plates, giving drawings of the mechanical design of modern alternating-current motors and, in this respect, the German work is more complete than the American original. The plates illustrate among other things a 375-hp induction motor and a three-phase railway motor for 400 hp., 900 r.p.m., 45 cycles and 1,150 volts, built by Siemens and Halske. Also a 10,000-volt motor built by the same firm for railway purposes is well illustrated in several plates. We cannot help admiring the care and skill employed by the Germans in the illustrations of their scientific and engineering publications, and such plates as the ones appended to this work are much to the credit of the publishers.

There is also a sin of omission in Behrend's book which should be made good in a future edition. There is a widespread idea that with the same magnetic circuit a squirrel cage induction motor has a higher power factor and overload margin than a motor with a Y-connected winding for the insertion of resistance, the erroneous argument being that a rotor winding with many phases, as a squirrel cage winding, is superior to the three-phase winding of the Y-connected rotor. Experimental evidence to the contrary would have been a welcome addition, especially as it would have had considerable weight coming from an engineer of such large experience.

BOOKS RECEIVED.

ELEMENTARE VORLESUNGEN ÜBER TELEGRAPHIE UND TELEPHONIE. By Dr. Richard Heilbrun. Berlin: Georg Siemens. 63 pages, illustrated.

DER DREHSTROMMOTOR. By Julius Heubach. Berlin: Julius Springer. 356 pages, 163 illustrations. Price, 10 marks.

THE PRACTICAL TESTING OF DYNAMOS AND MOTORS. By Charles F. Smith. Manchester: Scientific Publishing Company. 231 pages, 80 illustrations. Price, 5 shillings.

THEORETISCHE GRUNDLAGEN DER STARKSTROM-TECHNIK. By Charles Proteus Steinmetz. Braunschweig: Friedrich Vieweg & Son. 331 pages, 143 illustrations. Price, 10 marks.

DIE GLEICHSTROMMASCHINE. By E. Arnold. Berlin: Julius Springer. 665 pages, 484 illustrations. Price, 18 marks.

DIE MONTAGE ELEKTRISCHER LICHT UND KRAFTANLAGEN. By H. Pohl. Hannover: Gebruder Janecke. 272 pages, 328 illustrations. Price, 4.40 marks.

MESSUNGEN AN ELEKTRISCHEN MASCHINEN. By Rudolf Krause. Berlin: Julius Springer. 158 pages, 166 illustrations. Price, 5 marks.

ELEMENTS OF ELECTROMAGNETIC THEORY. By S. J. Barnett, Ph.D. New York: Macmillan Company. 473 pages, 145 illustrations. Price, $3.00.

A TEXT-BOOK OF ELECTRICAL MACHINERY. By Harris J. Ryan, M.E., Henry H. Norris, M.E., and George L. Hoxie, M.M.E., Ph.D. New York: John Wiley & Sons. 258 pages, 134 illustrations. Price, $2.50.

THE GAS ENGINE. By Frederick Remsen Hutton, E.M., Ph.D. New York: John Wiley & Sons. 483 pages, 243 illustrations. Price, $5.00.

ELECTRIC RAILWAY ECONOMICS AND PRELIMINARY ENGINEERING. By W. C. Gotshall. New York: McGraw Publishing Company. 243 pages. Price, $2.00.

DER ELEKTRISCHE LICHTBOGEN. Bei Gleichstrom und Wechelstrom. By Berthold Monasch. Berlin: Julius Springer. 266 pages, 141 illustrations. Price, 9 marks.

ENGINEERING PRELIMINARIES FOR AN INTERURBAN ELECTRIC RAILWAY. By Ernest Gonzenbach. New York: McGraw Publishing Company. 71 pages, 5 illustrations. Price, $1.00.

THE DYNAMO. By C. C. Hawkins and F. Wallis. London: Whittaker & Company. 925 pages, 413 illustrations. Price, $4.00.

A New Corporation to Extend the Tunnel System in Chicago.

With a capital stock of $30,000,000, the Illinois Tunnel Company has been incorporated at Springfield, Ill., to succeed the Illinois Telephone & Telegraph Company. The new corporation will take over the property and grants of the old one and will expend the additional capital in completing the 50 miles of tunnels required by its franchise, in the next ten years. Telephony will be merely a side issue with the new company. There is space in the tunnels for the telephone wires and that is said to be the reason the automatic service is being promoted. The real object is the transportation of freight.

The object of the new company, according to the articles which have been filed are: "To furnish, transmit, convey and deliver signals, sounds, intelligence, packages, mail matter and general merchandise, power, heat and light by steam, water, air, electricity and otherwise, and to acquire, construct, dispose of, hold, maintain,

operate and lease to or to rent from others all tunnels, instruments and appliances and other property, real or personal, in carrying out such objects."

Under its ordinance, the Illinois Tunnel Company is required to construct at least 50 miles of tunnel within ten years. Twenty miles of tunnel, 6 x 7 ft. in bore, have been constructed and heavy rails have been laid for the carrying of freight by motor car. The various railroad yards and depots have been connected with this tunnel in the down-town section and plans are ready for the extension of the tunnels to the stock yards and outlying districts. No freight is yet being transported through the tunnel, but it is said by the company officials that this part of the business will begin on or before July 1 next.

The new concern which succeeds to all the rights and privileges of the old company has a capital of $30,000,000, as compared with the $5,000,000 capital of the Illinois Telephone & Telegraph Company, which was organized and licensed June 23, 1898. The incorporators of the new company are Charles C. Wheeler, Henry A. Wilkening and Thomas A. Moran, Jr.

A Small Town Automatic Telephone Exchange at Hope Valley, R. I.

The accompanying diagrams and cuts illustrate the principal features of the Clark Automatic Telephone Switchboard system installed at Hope Valley, R. I., a town of about 900 population, and situated 40 miles southwest of Providence, R. I. The main leads

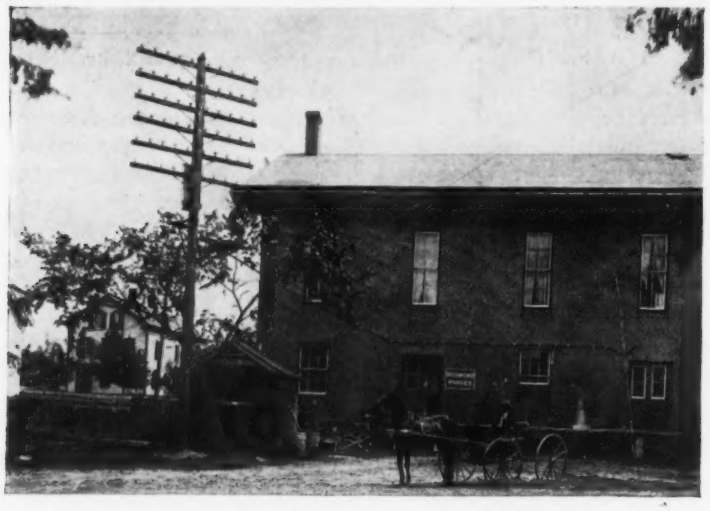


FIG. 1.—HOPE VALLEY TELEPHONE EXCHANGE AND CABLE POLE.

in the line construction consist of 30 and 35-ft. chestnut poles, equipped with standard 10-pin cross arms, locust pins and pony glass insulators, while in the country line construction 25-ft. chestnut poles, equipped with 6-pin cross arms, are used. All iron cross arm braces, bolts, washers, guy wire and anchors are of the best galvanized material. No. 12 B. B. galvanized iron wire is used for the talking circuit and a common return wire of No. 12 B. B. with weather-proof insulation completes the switching circuit. The object in insulating the common return is to prevent any likelihood of a cross with one of the talking wires, which is also used for switching purposes, as this would short-circuit the central switching battery and throw the system out of service. The wiring of the plant is such that the common return wire is used only fo. switching and might be replaced by a ground connection. It is obvious from the diagrams that it is possible to cut in transpositions on the line wherever necessary to balance up the circuits.

The system is operated by means of a central switching battery consisting of eleven American Battery Company's cells charged by means of a bank of 33 cells of gravity battery. This method of charging the storage battery is employed as the town has no light or power facilities from which charging current might be obtained.

A 75-pair weather-proof cable, made up of twisted pair, No. 19 copper conductors with rubber insulation, connects the line wires at the cable pole with the lightning arresters located in the switchboard room. From the lightning arresters the lines pass through a small panel of jacks, mounted near the toll operator's telephone, to the automatic switchboard. The automatic switchboard has a full complement of 72 switches, each subscriber requiring a separate switch, which is operated by a dial located at the subscriber's telephone. The telephones used in this exchange are of the Clark bridging type with adjustable arms and equipped with Clark automatic

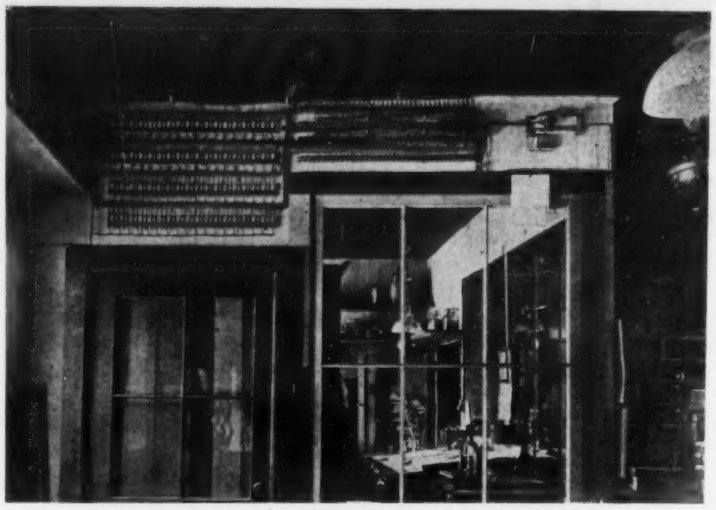


FIG. 2.—LIGHTNING ARRESTERS.

dial, Holtzer-Cabot three-bar, automatic clutch shunt generator, 1,000-ohm ringers and American Bell transmitters and receivers.

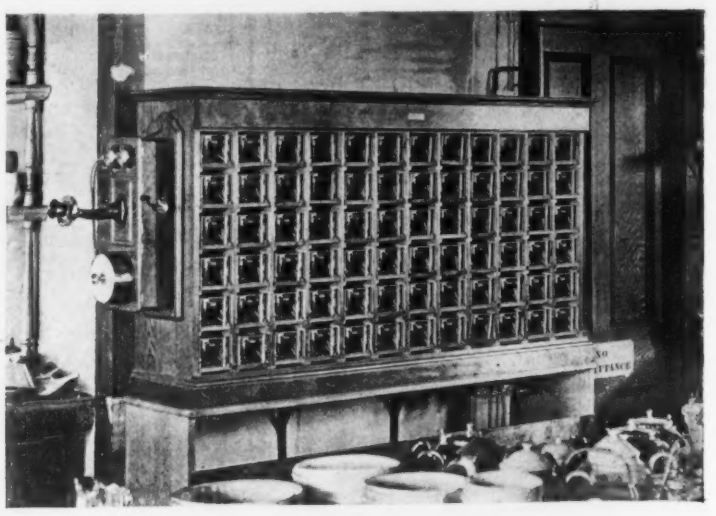


FIG. 3.—SWITCHBOARD FOR 72 SUBSCRIBERS.

A rural line four miles long is connected with the automatic switchboard, and by means of a special circuit the subscribers on

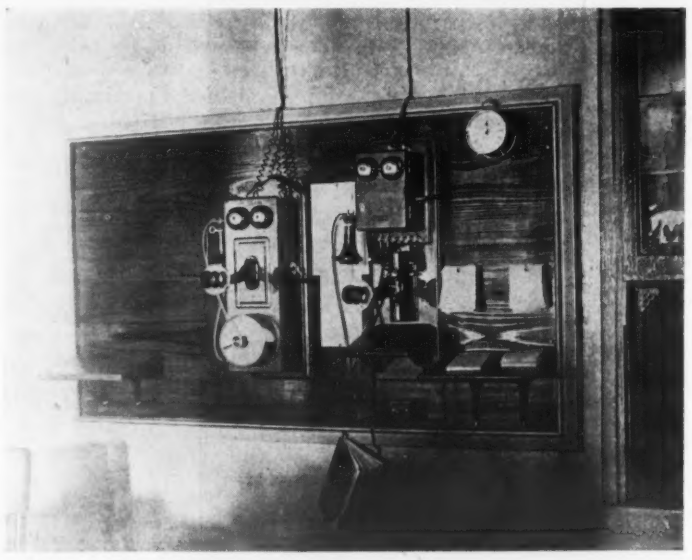


FIG. 4.—METHOD OF GIVING TOLL CONNECTION.

this line are enabled to call local subscribers automatically. This is accomplished by the insertion of a relay on the line, the automatic

switch operating off the local contacts of the relay, as shown in the diagram. By this method no increase in the voltage of the central switching battery is required. Subscribers in this exchange may call any long-distance point from their telephones as follows: The local toll operator is also a subscriber to the automatic system. When a subscriber desires a long-distance connection he first calls the toll operator, on the automatic telephone, and gives him the name of the party desired. When the toll operator obtains the long-distance connection, he simply trunks it through the jack panel to

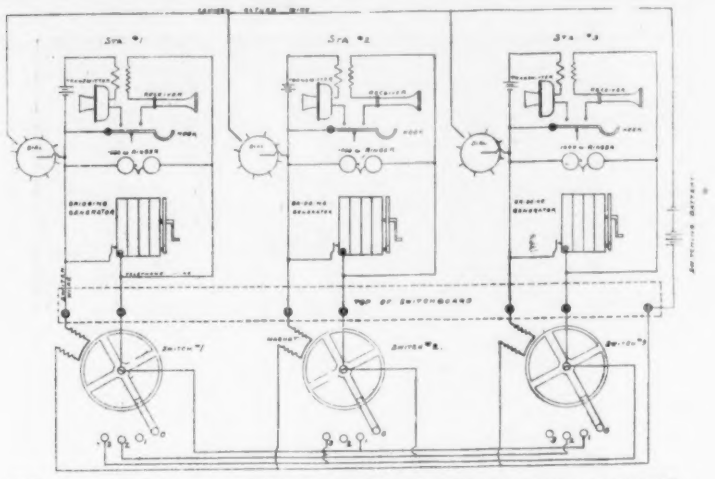


FIG. 5.—DIAGRAM OF WIRING OF BRIDGING SYSTEM USING COMMON RETURN FOR SWITCHING ONLY.

the local subscriber by means of a pair of cords, at the same time ringing the local party. On an incoming call the toll operator, on receiving the number wanted, trunks the long-distance call through the jack panel, at the same time ringing the local subscriber. The insertion of the jack panel referred to has a double value: First, in testing the lines, and secondly in making it possible to connect the automatic subscribers to the toll lines direct, thereby cutting them off the automatic system entirely and insuring an all-metallic connection independent of the local system.

When the construction of this plant was begun in May of the

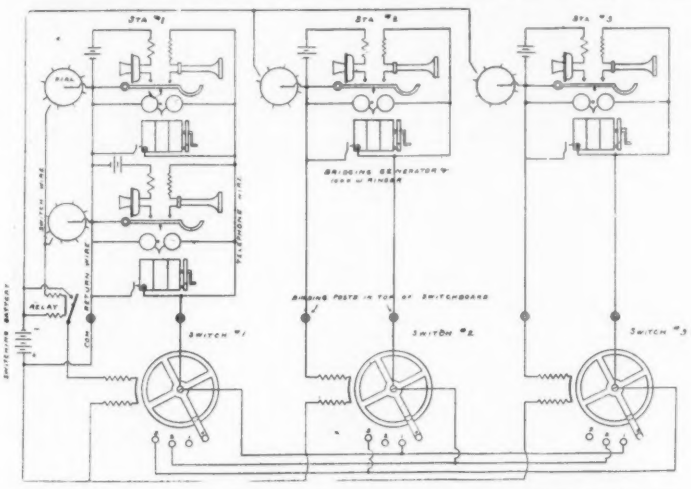


FIG. 6.—DIAGRAM OF WIRING FOR BRIDGING SYSTEM WITH RELAY ON LONG LINES.

present year it was on the basis of 30 signed contracts. The plant began operation in the middle of July with an increase of 50 per cent. in the number of subscribers. There has been, since that time, a further increase of 20 per cent., the total number of subscribers at the present writing being 54. The rentals obtained are $20 per year for residences and $24 per year for business houses.

Schuler-Ferranti Single-Phase Alternating-Current Motor.

The accompanying illustration shows a single-phase motor of the self-starting type, manufactured by Ferranti (Limited), Hollinwood, Lancashire, England. The core of the stator is built up of sheet-iron stampings, paper insulation being placed between the stampings. The stampings are clamped hard together by the frame, so as to minimize undue noise arising from the vibration of the stampings, and ample space is allowed all around the stampings for a free passage of air. The winding is in slots punched into the stampings, and consists of form-wound coils carefully insulated. The rotor is built up of iron stampings in the same way as the stator. The winding consists of rectangular bars. The rotor is provided with a commutator on one side and three slip rings on the other. The brushes bearing on the commutator are short-circuited by means of a copper ring and the brushes bearing on the slip rings are connected to the starting resistance.

The framework consists of a solid iron casting, circular in shape,

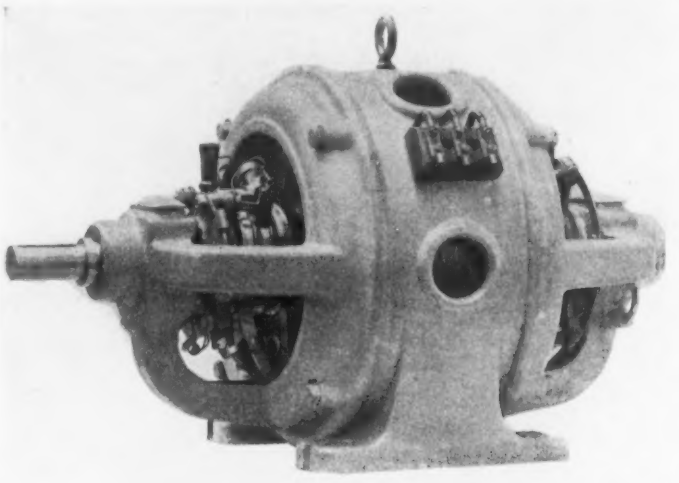


FIG. 1.—SINGLE-PHASE ALTERNATING-CURRENT MOTOR.

with ventilating holes in the volute to allow free circulation of air around the stator stampings. The bearings are supported on heavy cast-iron brackets, securely bolted at each side of the main framework; the bearings are of gun metal. An oil well is supplied to each bearing, cast in one piece with the bearing bracket. The lubrication is automatic, by the use of continuous oil ring lubricators; special oil throwers are provided to prevent the creepage of oil along the shaft.

When the current is switched on the motor starts up, the starting resistance is gradually cut out, thus causing the motor to attain full speed. The motor, it is stated, runs absolutely without sparking. Under ordinary running conditions the commutator carries no current

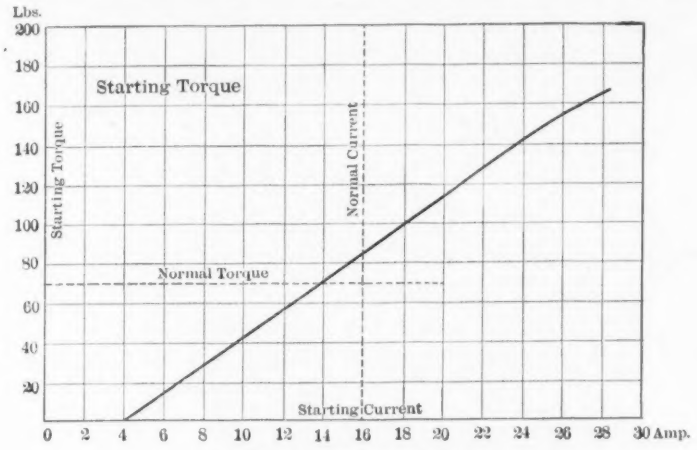


FIG. 2.—TORQUE CURVE.

and the motor will start against full load and give 1¼ times full load torque without increase of full load current. It can also be arranged to give twice full load torque at starting with only 50 per cent. increase of full load current. When starting against no load it will run up to speed, taking only about one-third of full load current. The direction of rotation can be reversed by a simple throw-over switch controlled, if necessary, from a distant point. The motor is particularly suitable for lift, crane or other power purposes requiring high starting torque, and hitherto outside the scope of the ordinary single-phase motor. The motor has a high efficiency and power factor, and is made for low and medium speeds. It is guaranteed to stand an overload of 50 per cent. for five minutes, and to start with any load up to 2½ times its normal full-load torque. After working at full load for six hours, the temperature rise is guaranteed not to exceed 70° F. above the atmosphere. The starting current is guaranteed not to exceed the following figures:

At a starting torque of 2½ times the normal, current not to exceed 100 per cent. above the normal; at double the normal torque, current not to exceed 50 per cent. above the normal; at 50 per cent.

torque above the normal, current not to exceed 20 per cent. above the normal; at 25 per cent. torque above the normal, normal current; at one-half of the normal torque, one-half of the normal current.

New Form of Incandescent Lamp Filament.

The Downward Light Electric Company, of New York, is placing on the market an incandescent lamp with a new form of filament designed to throw downward the greatest possible portion of the candle-power of the lamp. As will be seen, all but a small per-

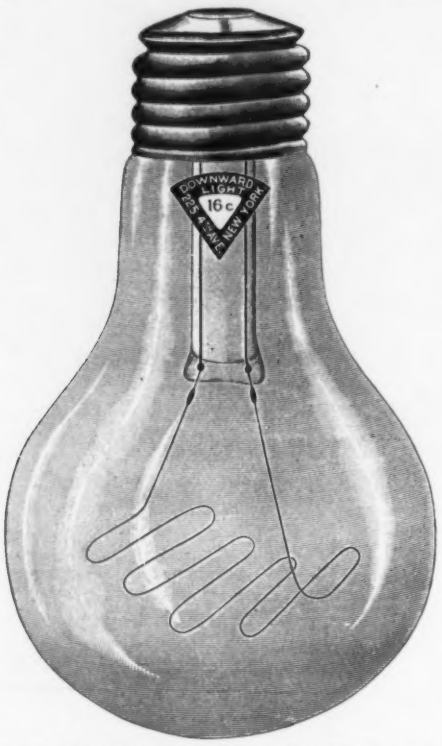


FIG. I.—DOWNWARD LIGHT INCANDESCENT LAMP.

centage of the length of the filament lies in nearly a horizontal plane when the lamp is placed vertically. The accompanying curves showing the distribution of light from this and other forms of filament have been plotted from tests made by the Lamp Testing Bureau, of New York. Curve 1 is from a double-filament lamp; curve 2 from an oval anchored filament; curve 3 from a double round filament;

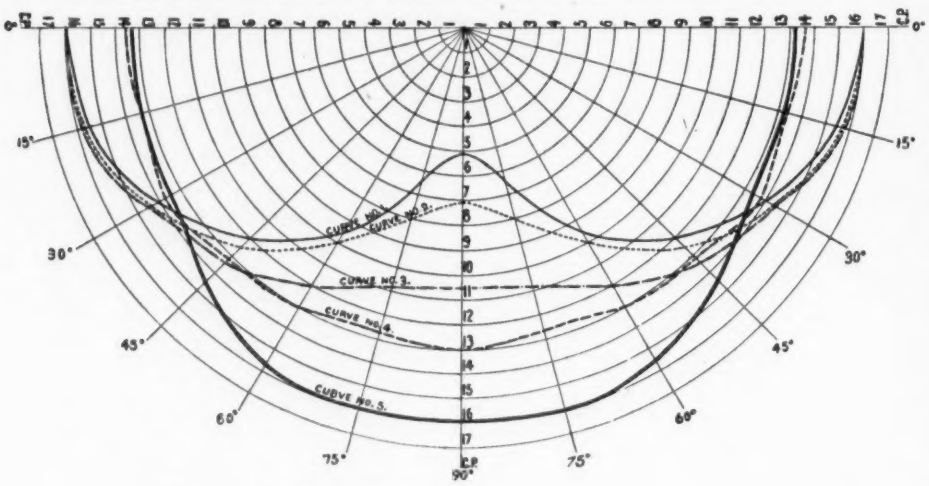


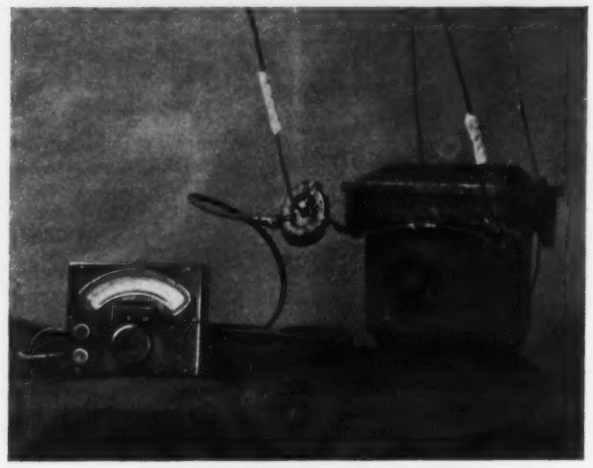
FIG. 2.—LIGHT DISTRIBUTION CURVES.

curve 4 from a flattened double lamp, and curve 5 from the "Downward" lamp. In every case the lamps tested were 16-cp incandescent lamps. The lamp is manufactured with a tipless bulb, thus still further facilitating the downward flux of light.

A Portable Line Meter.

The Denver Gas & Electric Company has been using lately a little instrument which is called by its manufacturers, the Portable Electric Instrument Company, of Denver, Colo., a portable line meter. The local company have employed it principally for balancing loads on their transformers and in locating transformers at the most advantageous points on the three-wire network. In many instances they have found transformers badly overloaded or unbalanced, which might otherwise have gone unnoticed until a burn-out occurred.

The meter, which is shown in use in the accompanying cut, takes the amperage anywhere on the line. It consists of a small series transformer with a ring-shaped core, one section of the ring being hinged to permit it being opened to place it over the wire carrying

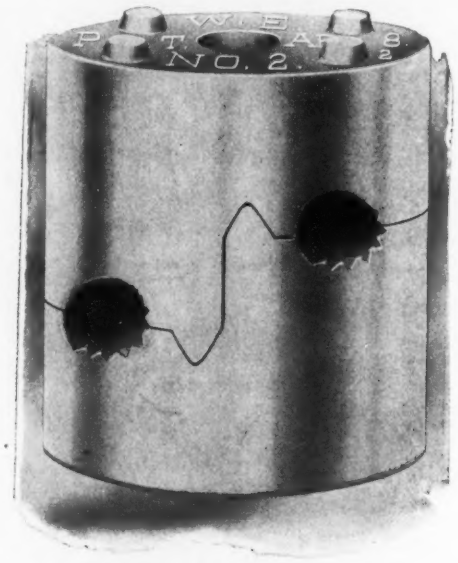


PORTABLE LINE METER.

the current. This little transformer is connected to a portable ammeter by means of 40 or 50 ft. of flexible duplex cable. The standard instrument will measure with a high degree of accuracy, it is said, loads of from 20 to 400 amp. In Denver two men in a single evening have covered a large down-town district and tested a large proportion of the transformers there.

A New Split Porcelain Insulator.

A new type of porcelain insulator, known as the "W. E." split porcelain insulator, has been put upon the market by the Western



PORCELAIN INSULATOR

Electric Company. The accompanying illustration gives a good idea of the general construction and appearance of this device. It is manufactured of highest grade porcelain, cylindrical in shape, and symmetrical with respect to the dividing line. The two parts are perfectly interchangeable. It is not intended to carry two conductors, as might at first glance be thought, one hole being too near the supporting surface to admit of this being done. The No. 1 knob takes wires from No. 10 to No. 14; the No. 2, from No. 6 to No. 8. The insulator is readily installed, the two pieces being fastened with one nail or screw. It is approved by the Board of Underwriters.

Switchboard Designed for Export.

Owing to the demand of its switchboards for export, Ferranti (Limited), Hollinwood, England, have designed a special type for the purpose, which is shown in the accompanying illustrations. The makers, in considering the design, appear to have fully recognized the difficulty in procuring skilled labor for erecting in many places and have produced a type of their well-known designs which can be very readily placed in position and connected up without requiring expert erection.

Fig. 1 is reproduced from a photograph taken of a board just before packing for shipment to Pietormaritzburg, and Figs. 2 and 3

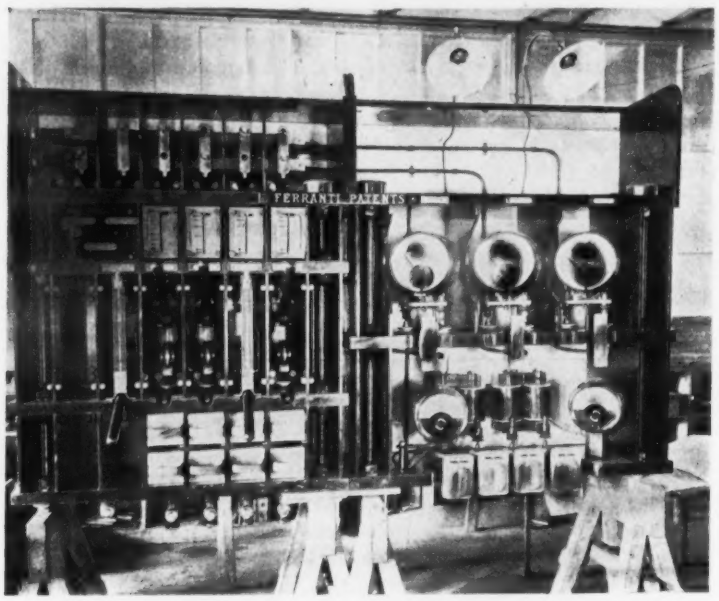


FIG. 1.—GENERAL ARRANGEMENT OF SWITCH GEAR.

illustrate clearly the method of packing, which is all-important for such work. It will be seen that the switch gear is made in complete self-contained sections, which are finished off in every detail at the maker's works. The sections are first surrounded by strong wooden

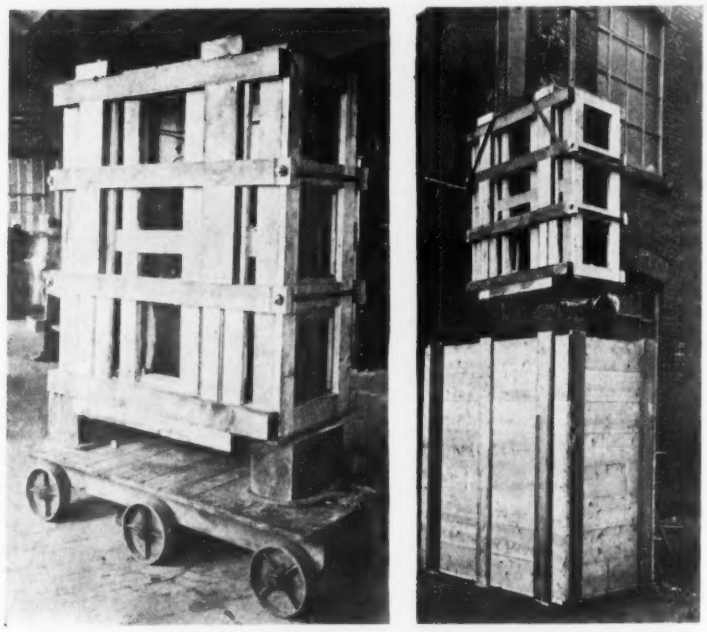


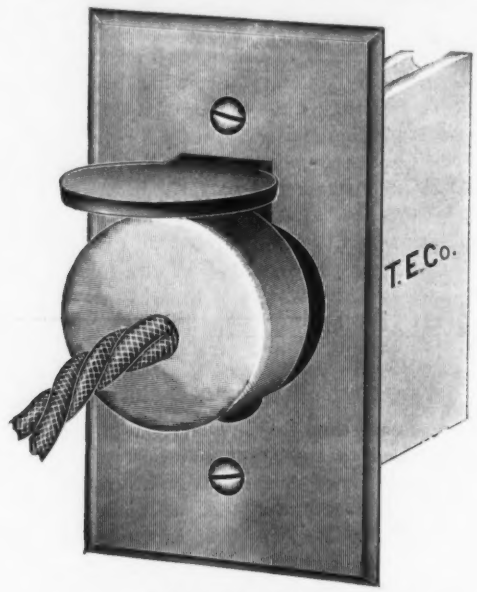
FIG. 2.—COMPLETE SECTION AND INTERNAL PACKING.

battens clamped together by iron bolts, and then the whole is let down into an external packing case, the space intervening between the two sets of packing cases being filled in with material of a springy nature. On arrival at their destination, it is only necessary to lift the section with the internal packing from the case and rest it upon the trestles or brick piers. Then only is the switch gear proper disclosed, and by the simple means of joining up the bus-bars with links provided for the purpose, the entire apparatus is made ready for service.

Great security is afforded by these designs, for which the makers make the following claims: Cellular type, minimizing fire and life risks; simplicity in construction, reducing possibilities of errors in manipulation; economy in floor and wall space occupied, designs self-contained and portable, uniform and symmetrical arrangements, no expert erection required outside the maker's works.

Flush Receptacle.

The main features of the flush receptacle shown in the accompanying illustration, made by the Trumbull Electric Manufacturing Company, Plainville, Conn., are that it fits into any standard switchbox without the use of a special plug. It is made to take the ordinary



FLUSH RECEPTACLE.

Edison base attaching plug, such as is used for tapping into an incandescent lamp fixture for a fan motor or a desk lamp. In this respect the receptacle is claimed to be unique.

Any person using an Edison plug will find this device a convenience, and with a great number of such attaching plugs in use and their immediate availability wherever any electrical supplies are sold, it is thought that contractors will find it desirable to install this type of receptacle. It is fitted with a nickel-plated cover.

Equipment for Queensland Railway Shops.

The most complete electrical equipment for operating machine tools, etc., hitherto installed in the Antipodes, has just been completed at the Ipswich shops of the Queensland government railways. The electrical machinery is all of American manufacture. The complete contract was undertaken by the engineering and contracting firm of Noyes Brothers, of Sydney and Melbourne, who represent the Westinghouse interests in Australasia.

There are three Westinghouse vertical compound condensing 250-r.p.m. engines of 300-hp capacity each. These engines are direct-connected to 200 kw, 60-cycle, two-phase, alternating-current generators of Westinghouse build operating at 220 volts. Exciter current is furnished from an independent 17½-kw direct-current exciter. The condensing plant consists of a Worthington combined air and circulating pump and a cooling tower. The latter is a cylindrical tower 15 ft. in diameter and 32 ft. high, built up of steel plates and packed with 12,000 interlocked tubes, giving a total cooling surface of 80,000 sq. ft.

Within each shop the electric current is distributed to the motors—161 in number—ranging from 1 hp to 75 hp, and having a total capacity of 1,200 hp, by means of overhead rubber insulated cables carried on the roof by glass insulators. The motors are of two-phase induction type, completely enclosed and self-lubricating. Many are suspended from the ceiling or placed on vertical walls.

Babcock & Wilcox secured the contract for the boiler plant, which consists of four units of 350 hp each. The C. W. Hunt Company, of Staten Island, was awarded the contract for the coal and ash-handling machinery.

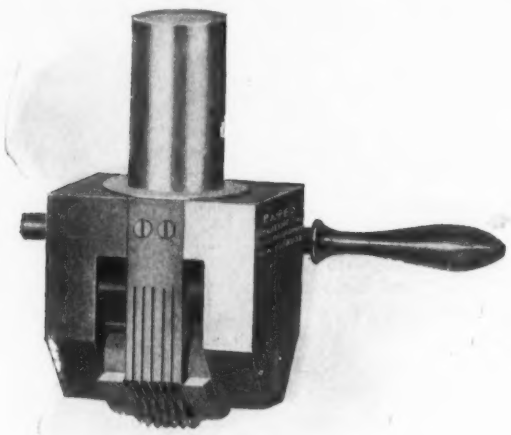
Machine Numbering in Metals.

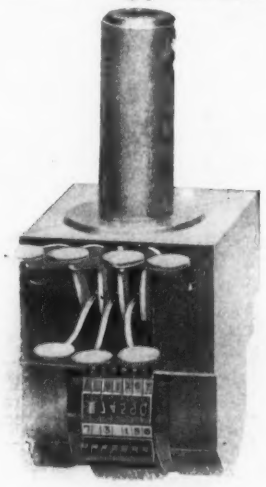
The operation of numbering name plates and metal parts has until recently remained a most unsatisfactory one, and the old method of employing individual figure stamps and hammer was not only crude, slow and expensive, but errors and irregularities constantly occurred and the appearance of the work was far from attractive. The machines here described are designed with a view of meeting the requirements, eliminating the many difficulties which have heretofore existed, and performing in an hour what was before considered a good day's work, in an infinitely superior manner—enhancing, rather than destroying the appearance of the parts upon which a number is to be placed. By their use consecutive numbering is accomplished with absolute accuracy, and any numbers which skip backward or forward, such as type and voltage numbers, may be impressed on the parts themselves or upon plates or tags to be attached to them. These machines are already in use to such an extent that their practicability has been fully tested, while it has been demonstrated that they are important factors in the saving of labor.

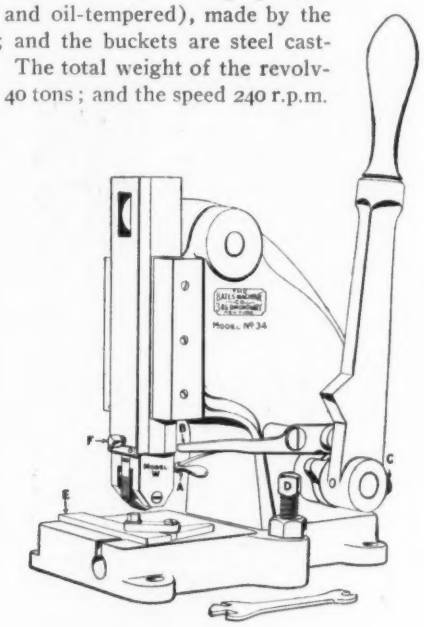
One form shown in Fig. 1 is designed for consecutively numbering gold, silver, steel, brass, copper, iron, tin, hard rubber, fibre, leather-covered and wooden instruments, or parts of any kind, size or shape, such as name plates for electric, gas and water meter tags, brass checks, steel keys, locks, watch cases, watch movements, steel bars and plates, etc. It may be operated in any punch, screw or lever press. The shank is made straight or to any taper and length desired. It is set up in the same manner as an ordinary punch, but the stroke of the press must be limited and carefully adjusted to the depth of the impression required. As the discs revolve, the figures are brought into correct alignment, are equally spaced apart and are sunk precisely the same depth, thus insuring perfect uniformity. The lever bar may be attached to any stationary part of the press, and the number will then advance automatically in consecutive order with each stroke. The figures and letters are made to any size desired and are cut upon "tool steel" wheels, carefully hardened and tempered.

Fig. 2 shows a style which is designed for stamping the style, size, grade, type, ampere, voltage and power numbers upon name plates, tags or parts of motors, dynamos, electric meters, etc. Any combination of letters and figures may be set instantly—skipping backward or forward—as is required for numbers which do not progress consecutively. Each numbering disc or wheel is provided with a lever which operates it independently of the others. The ends of the levers form a small keyboard. Remarkable speed is invariably attained as soon as the operator becomes practised. This experience is very easily acquired by an ordinary machine hand. The figures or letters which are in stamping position are always shown by the indicators on the front of the wheels just below the keyboard.

The hand lever bench press shown in Fig. 3 is designed to facilitate the operation of Figs. 1 and 2, but as before stated, any punch, screw or lever press may be utilized. Adjustable gauges are usually provided to which the pieces or parts to be numbered are fed. A toggle joint insures maximum power with comparatively slight pressure upon the lever. A consecutive numbering machine is shown in the cut. These machines are made by the Bates Machine Company, 346 Broadway, New York.







FIGS. 1, 2 AND 3.—NUMBERING MACHINE.

Bearings for Dynamos and Motors.

The Hobart Electric Manufacturing Company, Troy, Ohio, is using new bearings for its dynamos and motors, which have some features of merit. With its self-aligning, self-oiling bearings a hot box seems quite impossible. Superior machine work secures accurate alignment, but as an additional precaution the company provides for the self-adjustment of the bearing sleeve so as to secure exact and automatic conformity with the shaft. The sleeves are of the best anti-friction metal and are readily removable and interchangeable. The oil chambers are large. This reduces the attention to a minimum. The thrust collars provided for centering the shaft magnetically deserve especial consideration. These thrust collars provide against too great end play and secure the proper amount of end play, at the same time preventing the armature from being drawn against one bearing. Correct end play further facilitates lubrication and prevents the brushes from wearing grooves in the commutator.

Nimshew, Cal., Power House.

At the Nimshew power house of the Valley Counties Power Company, a sub-company of the California Gas & Electric Corporation, the first two machines have begun operation, feeding into the transmission line of the Bay Counties Power Company. The power house is located in the Butte Creek Canyon, 24 miles from Chico. The available total head of water is 1,531 ft., taken down in one pipe line 6,200 ft. long, and tapering in three sections, from 30 to 28½ in. diameter. Within the power house the pipe terminates in a Y, each branch of the Y supplying a 3,700-hp water wheel, the largest ones, it is stated, operated by one single jet of water.

The generators are of the Stanley Electric Company's make, the rotary element mounted on one single shaft with the water wheel. The entire hydroelectric unit runs in two bearings, the rotary element of the generator between the bearings, and the water wheel overhung. Shaft and wheel disc are nickel-steel forgings (the shaft being hollow, forged and oil-tempered), made by the Bethlehem Steel Company; and the buckets are steel castings of the ellipsoidal type. The total weight of the revolving part of each unit is over 40 tons; and the speed 240 r.p.m.

Each Doble wheel is provided with a Doble needle regulating deflecting nozzle and hydraulically operated piston gate, and a Lombard governor with electric speed controller taking care of the sudden fluctuations of the load by deflecting the nozzle; whereas the regulating needle is operated by hand and set according to the average load of the respective hours of the day. The hydraulic machinery, including shaft, bearings and gates, was designed and built by the Abner Doble Company, of San Francisco.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Speculation was dull and professional, and industrial stocks were unfavorably regarded on poor earnings showings and adverse indications as to iron and steel industrials. The traction stocks received support from local political sources, based on speculation attending the municipal contest in New York City. Despite the conflicting rumors in regard to the position of Amalgamated Copper, that stock held firm, although it was much less active than during the week previous. On Friday the market was dull in spite of its heaviness and the further indications of very poor bank averages for the week. Brooklyn Rap. Tran. closed at 35¼, a net gain of 1¾, the sales aggregating 57,150 shares. Met. St. Ry. fluctuated between 107⅛ and 111½, closing at 109¾ a gain of 2¾. Man. Elev. made a gain of 2 points; closing at 135¼. The electrics were firmer and showed an advancing tendency. General Electric reached 153¼, but closed at the week's lowest figure—148½. This, however, is a gain of ½ point. Westinghouse common made a net gain of 6 points, closing at 137. Western Union gained ¾ point net, closing at 82¾. Following are the closing quotations of November 4:

NEW YORK.

	Oct. 27	Nov. 4		Oct. 27	Nov. 4
American Tel. & Cable	78	78	General Electric	150	150
American Tel. & Tel.	123	129	Hudson River Tel.	..	..
American Dist. Tel.	24	24	Metropolitan St. Ry.	110	110¼
Brooklyn Rapid Transit	34⅞	35⅛	N. E. Elec. Veh. Trns.	..	..
Commercial Cable.	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	17	20	Marconi Tel.	..	..
Electric Boat pfd.	41	44	Western Union Tel.	82⅝	83
Electric Lead Reduction	*1⅛	*1⅜	Westinghouse com.	137⅝	136
Electric Vehicle.	5	5½	Westinghouse pfd.	165	165
Electric Vehicle pfd.	8	8			

BOSTON.

	Oct. 27	Nov. 4		Oct. 27	Nov. 4
American Tel. & Tel	123¾	127½	Western Tel. & Tel. pfd.		75
Cumberland Telephone	*115	..	Mexican Telephone	*1⅜	1⅜
Edison Elec. Illum.	231	244	New England Telephone	123	*123½
General Electric	149	150	Mass. Elec. Ry.	19	18¼
Western Tel. & Tel.	*10	8⅜	Mass. Elec. Ry. pfd.	77⅛	77½

PHILADELPHIA.

	Oct. 27	Nov. 4		Oct. 27	Nov. 4
American Railways	42⅛	43	Phila. Traction	94	95¼
Elec. Storage Battery	*50	47	Phila. Electric	5⅜	6⅜
Elec. Storage Battery pfd.	*50	47	Phila. Rapid Trans.	12⅜	12
Elec. Co. of America.	7⅜	7⅜			

CHICAGO.

	Oct. 27	Nov. 4		Oct. 27	Nov. 4
Central Union Tel.	..	..	National Carbon pfd.	85	..
Chicago Edison	..	140	Metropolitan Elev. com.	17	17
Chicago City Ry.	169	167	Union Traction	7¼	6
Chicago Tel. Co.	..	115	Union Traction pfd.	32	30
National Carbon	15	17¼			

*Asked

CHICAGO RAILWAYS COMPANY.—Application has been made for articles of incorporation of the Chicago Railways Company, which, it is said, will be the financial factor in the solution of the problems confronting the Union Traction Company and its underlying corporations. The commissioners making the application are Nathan C. Johnson, W. E. Cooper and Archibald G. Thiselton. Mr. Alfred Skitt is said to be the prospective president, as well as a director of the company, and Harry B. Hollis, now a director of the Union Traction Company, has tendered his resignation of that office, and will be associated with Mr. Skitt in the directory of the new corporation. While the capitalization of the new concern is placed nominally at $10,000, it is said to be the purpose of its promoters to increase it, as soon as the organization is complete, to $5,000,000, and later to a figure that will cover the amount required for the rehabilitation of the North and West Side systems. The new company is declared to be not organized for any purpose unfriendly to the receivership of the Union Traction Company, and any leases which may be made by it will be subject to the termination of the receivership.

CINCINNATI GAS & ELECTRIC.—The Cincinnati Gas & Electric Company reports that during the past three months 43,000 new gas services have been established and 27,000 new gas ranges have been disposed of. Within the same period the gas consumption has been 60,000,000 ft. greater than during the same period last year. In the three months 22,000 electric lights have been installed. The daily consumption of gas is increasing at the rate of 600,000 to 900,000 ft. over last year at this time. The electric output has increased over 20 per cent.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company reports for Sept., 1903, its output of instruments to be 79,406, which, after deducting returns of 33,438, there is left net output for the month of 48,968, against 31,677 in the corresponding month last year. The increase is 14,391. From Jan. 1 to Sept. 30, there is a decrease of 8,247 instruments, compared with the corresponding period last year. The output thus far in 1903 is 453,398. Outstanding instruments, total 3,603,718.

MONTREAL TROLLEY EARNINGS.—The Montreal Street Railway reports as follows for the year ended Sept. 30, 1903:

	1903.	1902.	Changes.
Gross	$2,222,000	$2,046,000	Inc. $176,000
Expenses	1,317,000	1,135,000	Inc. 182,000
Net	$905,000	$911,000	Dec. $6,000
Earned on capital stock	11.41%	11.68%	Dec. .27%
Passengers carried	54,500,000	49,900,000	Inc. 4,600,000

The decrease in net earnings was due to two strikes, one in February and another in May. Computing the loss of car earnings together with expenses of these strikes, brings the net earnings down some $200,000. The dividends paid during the year amounted to $600,000. During the year $1,000,000 new stock was issued for extensions.

AMERICAN LIGHT & TRACTION makes the subjoined annual report for the year ended June 30, 1903:

	1903.	1902.	Changes.
Dividends received	$1,006,593	$769,093	Inc. $237,500
Other income	85,470	24,240	Inc. 61,230
Total income	$1,092,063	$793,333	Inc. $298,730
Expenses	25,078	20,071	Inc. 5.007
Balance	$1,066,985	$773,262	Inc. $293,723
Preferred dividend	528,337	457,015	Inc. 71,322
Surplus	$538,648	$316,247	Inc. $222,401

DIVIDENDS.—Directors of New England Telephone & Telegraph have declared a regular quarterly dividend of 1½ per cent., payable November 14. The directors of the Consolidated Gas Company, of New York, have declared the regular quarterly dividend of 2 per cent., payable December 15. The Nassau Electric Railroad Company has declared a dividend of 4 per cent. on its preferred stock, payable November 14.

TWO-CENT TROLLEY FARES.—A proposition to build and equip four street railways to be operated at a straight two-cent fare has been received by the City Clerk of Cleveland. The proposition was made by William Christy through his attorney, C. W. Collister. Mr. Christy has for years been actively interested in the street railroad business in Cleveland and other cities.

TROLLEY ROAD LIEN.—The Vandergrift Construction Company, of Philadelphia, has filed a lien for $112,944.82 against the Hampton Roads Railway & Electric Company, which recently went into the hands of a receiver. The sum claimed is balance due on construction work for the railway line, which was built by the Vandergrift Company.

Commercial Intelligence.

THE WEEK IN TRADE.—Cooler weather has stimulated retail trade generally throughout the country, and this is reflected in the increasing demand for seasonable goods. The movement of the crops in the northwest, west and south has been freer, and interior collections have improved. While buying is classed as conservative, eastern jobbers note a more cheerful tone in trade. The tendency to scale down the gains hitherto reported is still shown in reports of railway earnings. Up to the end of October the gain of all roads reporting is close to 7 per cent. The labor situation is rather unsettled, and it is openly stated that the suspensions of industries of late and the retrenchment policies of the leading railroads have been partly inspired to curb foolish tendencies on the part of labor organizations. Agricultural producers show a tendency to refuse to accept lower prices for their surplus and there is an immense demand from millers. Cotton also exhibits the same tendency, producers showing no inclination to part freely with their product, though prices are 1½ cents higher than a year ago. In lumber there is a better tone, and other building material is steady. In

iron and steel few changes are noted, the trade being weak. Finished products were strong, notwithstanding the cuts in crude material. Hardware is reported active. The shut down of the Amalgamatel Copper mines has had a strengthening effect on that metal. The output of those mines is placed at 20,000,000 pounds monthly. The market was rather excited on the report of the closing down of the Amalgamated mines and consumers rushed in to buy for early as well as later delivery. Prices advanced rapidly, and closed strong at the following quotations: Lake 13½ to 13¾c.; electrolytic, 13¼ to 13½c.; cathodes 13 to 13¼c.; casting stock 13⅛ to 18⅜c. The business failures for the week ending Oct. 29 as compiled by *Bradstreet's*, aggregated 217, as compared with 216 the week previous and 194 the corresponding week last year.

FOREIGN TRADE.—The classified trade report for September makes some interesting comparisons. The decrease of imports was chiefly composed of "animals and food," mostly sugar. Activity of manufactures is indicated both in the increase of crude materials by $3,278,912, and the decrease of "partly manufactured" by $3,963,273. The changing aspect of international trade is well shown in the decrease of imports of luxuries by $444,451, against an increase for the nine months of $9,036,553. The import of pig iron was over a million less than in the previous September, and the total decrease of iron and steel products was over two millions. The decrease of agricultural exports was larger than the total decrease of exports, there being an increase of exports of several classes, the largest being $1,473,369 for manufactures. This is more than a million over the increase for nine months, indicating that some lost ground is being regained. The exports of electrical machinery for the last nine months amounted to $3,875,093 as compared with $4,399,151 for the nine months last year, due to the springing up of large American factories abroad, for heavy material; but the demand for electrical specialties is very large.

CANADIAN NICKEL.—By the recent purchase of a controlling interest in the Bruce Nickel Mines of Sudbury, Ont., Chas. M. Schwab and his associates in the International Nickel Company become dominant factors in the Canadian Nickel ore field and ultimately will be in position to control the world's output. Through the subsidiary Canadian Copper Company the International Nickel Company acquired for $600,000 the famous Bruce mines on the north shore of Georgian Bay. The mines were bought in 1847 by an English corporation for $200,000. About $10,000,000 worth of ore has been taken out. Since 1870 they have been worked only occasionally. The International Nickel Company will utilize the ore for a flux for its new smelting plants at Sudbury where $1,000,000 is being spent in reduction works. Mr. Edison is understood to be heavily interested in Canadian nickel. He uses large quantities of nickel in his new storage battery.

ANOTHER EL ORO POWER PROJECT.—Another group of American capitalists contemplate the construction of power transmission lines into the El Oro mining district. As mentioned in our last issue, the Mexican Light & Power Company, Limited, propose to generate current at its huge Necaxa plant for transmission to El Oro, some 100 miles distant. It has since been learned that the Guanajuato Power & Light Company, Limited, which has just completed the construction of a transmission line between the Douro River and the Guanajuato mining region, more than 100 miles long, will immediately begin work on a large hydraulic plant in the State of Michoacan, which will generate current to be carried 45 miles to the El Oro and Tlalpujahua camps. Contracts have already been secured for several thousand horse power. Mr. H. Hine, formerly of the Stanley interests, is president of the Guanajuato Company.

HIGH PRICE OF SHELLAC.—One of the articles of large consumption in more than one electrical art is shellac, of which there now appears to be a short supply. In January, 1900, S. A. S. shellac, which is one of the standard medium grades, sold at 16⅞ cents a pound. To-day the same quality commands 52 cents a pound in the wholesale market. The advance began in 1901, when the price went to 22 cents, then to 29 cents, and early in 1902 it was quoted at 32½ cents. Since then it has been steadily rising. T. N., the lowest grade of shellac, is now selling at 48 cents. During the period from January to September 53,241 cases, each containing about 240 pounds of shellac, have been imported. During the same period last year 44,222 cases were imported, and in 1901, 51,900 cases. The new crop comes to market in January and February, but no decrease in price is looked for then.

GRASS VALLEY MINING PLANT.—The New York Grass Valley Gold Mining Company's big plant, Grass Valley, Cal., is in operation and more stamps are being installed to increase the output. No new building will be erected for the electric light plant, as it will be installed in a building that has already been put up for that purpose. The plant will be of about 100 lights, which will light the mine throughout, underground, in the various levels, shafts, etc., as well as the tunnel and the entire mine and plant. The electric plant as well as the mill, stamps, concentrators, compressor, hoist, pumps, etc., are all run with free water power owned by the company. This big mine and plant will within one year be the largest in the district.

TELPHERAGE FOR JACKSONVILLE, ILL.—The Jacksonville Gas, Light & Coke Company has just installed a coal-hoisting and handling system purchased from the United Telpherage Company, of 20 Broad Street, New York City, which has of late developed quite a large business with gas and electric light plants for moving their coal and ashes. At Jacksonville the coal is delivered to a large hopper, from which the telpher hoist loads and transports it to various points in the coal shed, holding about 1,500 tons. The hoist handles 1,200 pounds at a time. The plant was installed by Mr. F. G. Roberts, of the Telpherage Company.

SEWER CONTRACT FOR G. M. GEST.—At a special meeting of the West Orange Town Council last week for the purpose of passing on the application of the Harrison Construction Company, which desired to transfer its contract for building section 1 of the outlet sewer to Guy M. Gest, the electrical subway contractor of New York, the sewer committee reported favorably on the matter and the transfer was made, the work to be done for the same amount and under the same terms as those assumed by the Harrison company. Mr. Gest gave bonds for $10,000 to insure the faithful performance of the contract.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, of Chicago, reports a long list of exchanges which it has recently equipped with apparatus, either the regular express switchboard or the Bell express type of central office equipment. The following is a partial list of the most recent shipments: Wilmont, S. D., 100-line Bell express; Effingham, Kan., 200-line Bell express; Topeka, Kan., 25-line Bell express; Troy, N. C., 100-line Bell express; Frankfort, Kan., 100-line express; Hale, Mo., 200-line express; Fort Riley, Kan., 50-line Bell express; Kingman, Ariz., 150-line express; Trenton, Mo., 100-line express; Chillicothe, Tex., 25-line express.

AJAX MOTOR VEHICLE COMPANY.—The Ajax Motor Vehicle Company, of 220 West Thirty-sixth Street, New York City, has made an assignment to Charles G. Cornell. The company was incorporated in July, 1901, with a capital stock of $10,000, with Alfred L. Simpson as president. In January last the company's statement showed assets of $54,000 and liabilities of $20,500. The company manufactured electric automobile runabouts, motors, etc. The assignment is attributed to dull business. The business does not appear to have gone beyond the experimental stage.

ST. LOUIS EXPOSITION.—Although the St. Louis Exposition is built partly upon a side hill, it will be necessary to raise some of the drainage and sewerage by pumping, in order to effect its disposal. For this purpose the authorities have purchased from Henry R. Worthington four 12-in. vertical centrifugal sewerage pumps, each having a capacity of 3,000 gallons per minute and capable of operating against a head of 60 ft. These pumps will be driven by Westinghouse vertical-shaft induction motors.

GENERAL ELECTRIC EQUIPMENT FOR MEXICAN MINES.—The Guanajuato Consolidated Mining & Milling Company, which operates one of the more important properties in the Guanajuato mining district, Mexico, has placed a contract with the General Electric Company for considerable electrical equipment to displace steam power hitherto utilized by the company. Several further contracts for motors, etc., are expected to be let shortly for use in other mines in the same vicinity.

STROMBERG-CARLSON TELEPHONE MFG. COMPANY, of Rochester, N. Y., reports that its underground cable department located there is running full blast. A recent shipment of 60,000 ft. of underground cable was made to the Keystone Telephone Company of Pennsylvania. They are so situated as to be able to make the cable according to any specifications submitted.

A LARGE TELEPHONE ORDER.—The Kellogg Switchboard & Supply Company, Chicago, has lately received an order from the Cuyahoga Telephone Company of Cleveland for 8050 telephones, 5000 wall sets, 2500 desk sets and 550 pay station sets. The Kellogg Company is building for the same telephone company an 18,000 line board.

LUNKENHEIMER FRENCH OFFICE.—The Lunkenheimer Company of Cincinnati has experienced a growing demand for its valves and specialties in France, and has opened a branch office at 24 Boulevard Voltaire, Paris, where it will carry a complete stock of goods.

ORDER FOR TELEPHONE RECEIVERS.—The Lambert Schmidt Telephone Mfg. Company, of Hoboken, N. J., has just received a contract from the Eastern Telephone Company of Philadelphia for 5000 high grade double pole receivers. The award was not made on price, as there was severe competition.

FAILURE OF JANSSENS.—The Société Anonyme des Etablissements Janssens, of Paris, which concern was the largest handler of American machine tools and other machinery in France, and one of the biggest in Europe, has gone into bankruptcy. The Société had been laboring under financial difficulties for a considerable time past. There are several American creditors. The Société was organized in 1901 for the purpose of taking over the extensive business of Adolphe Janssens. Previous to that date British machinery exclusively was imported. Since the formation of the Société fully $4,000,000 worth of Yankee labor-saving devices went through the books. Branch establishments were opened in Belgium and in anticipation of an extensive trade during the Paris Exposition huge contracts were placed in the States for machine tools of all descriptions. The looked-for business did not all materialize. Mr. Janssens shortly after the exposition closed relinquished the active management of the concern. He was succeeded by his son, who had had but little experience in the business. The failure is attributed to too heavy expenses and mismanagement. Machinery in many cases was sold for little or no profit. For instance, one lot costing $10,000 was sold delivered in Spain for only $10,075. The Société was mulcted in large penalties for non-delivery on time on large quantities of machine tools for the French arsenals. Among the American creditors are the Watson-Stillman Company, 204 East Forty-third Street, New York; the Union Manufacturing Company, of New Britain, Conn.; Manning, Maxwell & Moore, 85 Liberty Street, New York; the Standard Tool Company, of Cleveland, Ohio; Warner & Swasey, of Cleveland, Ohio; the New Haven (Conn.) Manufacturing Company, the Springfield Machine Tool Company, of Muskegon Heights, Mich.; the J. A. Fay & Egan Company, of Cincinnati, Ohio. The German house of Schuchardt & Schutte, who are the largest handlers of American machinery on the other side, represent the interests of several American creditors. They have just opened branch stock rooms in the French capital. The New York offices of the concern are in the Beard Building. The American creditors' claims foot up a total of some $50,000. It is expected from the information so far in hand at this end that the Société will be able to pay at least 20 cents on the dollar.

ELECTRIC POWER PAPER MILL.—The extensive improvements at the mills of the George H. Friend Paper & Tablet Company, Dayton, Ohio, have made it one of the most up-to-date plants in the country. A complete electrical equipment displaces the long lines of shafting, steam piping and auxiliary engines and permits the operation of the several departments from one central station. The generating plant consists of a 450-kw Thresher multipolar generator directly connected to a Harrisburg tandem compound engine, running at 150 r.p.m. Thirty-two motors ranging in size from 1 to 200 hp, also manufactured by the Thresher company, are located throughout the plant, operating individual machines or groups of machines according to the character of the work to be performed. The installation of motors for driving the supercalenders deserves special mention, as it is the first time these machines have been thus equipped, and is a marked advance in economy of operation. The problem is a difficult one, as the machine requires a large amount of power and wide variation of speed. Each machine has an independent motor, controlled from one panel located so as to be under the hand of the operator.

FLATS AND ELECTRIC ELEVATORS.—Mr. H. H. Neil, a real estate expert, says in the *New York Mail and Express:* "The introduction of the electric elevator to the west end, five years ago, was one of the most important developments in the history of uptown real estate, and it was freely predicted at the time that no more flats of the older type would be built west of Central Park. This prediction has not been found false as yet, but there seems to be a possibility, in the enormously increased demand of late for old-fashioned flats, that early expectations in this matter may have to be somewhat modified. The facts is that the new building law, while it was at first expected to make the builder of five-story buildings most unhappy, has proven just as severe, and perhaps more severe, upon the builder of seven-story apartment houses. The latter, in fact, can no longer be produced with any hope of economical profits. Nor can the five-story flat of the old kind." The general introduction of electric elevators in dwellings is a distinct feature of New York life.

GENERAL ELECTRIC ITALIAN CONTRACT.—The Mediterranean Thomson-Houston Company, which is largely controlled by General Electric interests, has secured a contract for the construction of a large hydraulic power plant to generate current for transmission to Turin, Italy. The plant is to be built at the foot of Mont Cenis. Its initial capacity will be 4200-kw. The equipment will consist of three twelve-pole turbine-driven three-phase alternators of 1400-kw capacity each. The generating pressure will be 3000 volts. The line pressure is to be 30,000 volts. The length of the transmission line will be about 40 miles.

GERMANY IN CHILI.—A joint stock company, with a capital of 5,000,000 marks ($1,190,000), has been organized at Valparaiso for the purpose of securing control of water power, erecting an electric light and power plant, and taking over the horse car lines. The largest stockholders in this company are German firms, viz.: Siemens-Schuckertwerke, Allgemeine Elektrizitätsgesellschaft, Die Union Elektrizitätsgesellschaft, and a group of banking houses, to which the Berliner Handelsgesellschaft, the Deutsche Bank and the Diskontogesellschaft belong.

EQUIPMENT FOR SYDNEY TRACTION SYSTEM.—The Allis-Chalmers Company has secured the contract for the engines to be installed in the additional sub-stations now under construction for the Sydney, N. S. W., City and Suburban electric traction system. The rotary converters—900-kw—with necessary transformers are to be General Electric. This plant is to be considerably enlarged very shortly and the additional power may be generated by means of steam turbines.

LIGHTING EQUIPMENT FOR YOKOHAMA.—The Yokohama (Japan) Union Electric Light Company is about to let contracts for an extension to its plant. There will be a 600-kw, 2400 volt, two phase, 60 cycle, 120-rpm field type alternating current generator direct connected to a cross compound side crank condensing engine of 900-hp capacity, or else a turbo-generator. It has not been decided yet as to whether rotaries or induction motors will be ordered.

RAILWAYS IN ITALY.—The Mediterranean Railroad of Italy, in conjunction with a number of foreign firms—for the most part German—is contemplating building an electric railroad from Rome to Naples. For this purpose it proposes to ask the government, in the near future, for the necessary concession. This road will be about 130.5 miles in length, and the estimated cost thereof $19,300,000.

GEO. C. TOWLE MANUFACTURING COMPANY.—At a meeting of the directors of the George C. Towle Manufacturing Company, held on October 19, it was decided to increase the capital stock of the company to $50,000 and to change the name of the company to the Fidelity Electric Company. Due application is now to be made to the State to the above effect, for proper authorization.

LIGHTING AT VLADIVOSTOCK.—The growing city of Vladivostock, Siberia, needs an electric light plant. It has 40,000 inhabitants. An English firm made a favorable offer for the plant, which was for a time under consideration and is now before the municipal board. A Seattle firm had this same electric offer under consideration but could not see its way clear to accept it.

IRON CITY ENGINEERING COMPANY, Frick Building, Pittsburg, Pa., has secured contracts for two complete electric light plants to be installed at Ord and St. Paul, Neb. It is also installing the electrical equipment in the new shops of the Hockensmith Wheel & Mine Car Company, Penn Station, Pa.

5000-KW CURTIS' TURBINE IN SERVICE IN CHICAGO.—The first unit consisting of a 5000-kw Curtis' turbine is now running, it is reported, on regular commercial service at the Commonwealth Electric Company, of Chicago's new plant. Two more units of similar capacity are now being installed.

ELECTRICAL SUPPLIES FOR ABROAD.—The American General Trading Company, 136 Liberty Street, New York, of which concern Geo. E. Austin is manager, has some substantial contracts in hand for various electrical supplies for export to Mexico, Brazil and the Hawaiian Islands.

VARIOUS EQUIPMENT FOR JAPAN.—The Japanese house of Mitsui & Company is about to place some substantial contracts in this market for electrical equipment for the Far East. The firm is also figuring on big equipment for which orders are expected to be placed here.

GENERAL ELECTRIC MEXICAN CONTRACT FOR TRANSFORMERS.—The General Electric Company has been allotted the contract for the transformers, 45,000 hp all told, by the Mexican Light & Power Company for its Necaxa-Mexico City power system.

BALL ENGINE ORDER.—The Ball Engine Company, of Erie, Pa., will install three 450-hp engines direct connected to generators for the Milwaukee Coal & Coke Company, Milwaukee, Wis. These engines are to be used for by-product coke ovens.

LIGHTING IN PEKIN.—It is reported that a Hamburg firm has received an order to equip the Chinese Emperor's palace at Pekin with electricity. For this purpose dynamos, four steam engines and sixteen transformers will be required.

TELPHERAGE FOR JAPAN.—The Imperial Steel Works, of Japan, have just placed an order with the United Telpherage Company, of New York, for a telpher plant intended to handle coal, supplies, material, etc.

CUTTER CIRCUIT BREAKERS FOR ENGLAND.—The Cutter Company, of Philadelphia, has just received a large British contract which calls for some 100 circuit breakers of various sizes.

SUBMARINE BOATS.—The Holland submarine electric torpedo boats *Porpoise* and *Shark* have been accepted by the Secretary of the Navy.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrochemical Society. Secretary, C. J. Reed, 929 Chestnut Street, Philadelphia, Pa.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty Street, New York. Meetings, last Friday each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Ave., Detroit, Mich.

American Street Railway Association. Secretary, T. C. Pennington, 2020 State Street, Chicago.

Association of Edison Illuminating Companies. Secretary, W. S. Barstow, New York City and Portland, Ore.

California Street Railway Association. Secretary, J. E. Morris, Oakland, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Hamilton, Ont., 1904.

Chicago Electrical Association. Secretary, W. B. Hale, 242 South Jefferson Street, Chicago.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, A. E. Pond, New Haven, Conn.

Electrical Trades Society (Member National Electrical Trades Association). Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets second Friday of each month.

Illinois State Electric Association. Secretary, H. E. Chubbuck, LaSalle Ill.

Indiana Public Utilities Association. Secretary, A. M. Barron, Indianapolis, Ind.

Independent Telephone Association of the United States. Secretary, Frank G. Jones.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Pichardt, Huntingburg, Ind. Next meeting, Evansville, Ind., Nov. 11, 1903.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y.

Interstate Independent Telephone Association. Secretary, E. M. Coleman, Louisville, Ky. Next meeting, Chicago, Ill., December 8, 9 and 10, 1903.

Iowa Electrical Association. Secretary, W. S. Porter, Eldora, Ia.

Iowa Telephone Association. Secretary, C. C. Deering, Des Moines, Ia. Annual meeting, Des Moines, March 8, 1904.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ind.

Maine Street Railway Association. Secretary, E. A. Newman, 71 Congress Street, Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass.

Michigan Interurban and Street Railway Association. Secretary, Benjamin S. Hanchett, Jr., Grand Rapids, Mich.

National Arm, Pin & Bracket Association. Secretary J. B. Magers, Madison, Ind. Next meeting Chattanooga, Tenn., Nov. 10, 1903.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y. Next meeting St. Louis, Mo., September 14, 15 and 16, 1904.

New England Street Railway Club. Secretary, J. H. Neal, 101 Milk Street, Boston, Mass.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

National Electric Light Association. Secretary, Ernest H. Davis, Williamsport, Pa. Next meeting, Boston, Mass., May or June, 1904.

Northwestern Electrical Association. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis. Next meeting, Milwaukee, Wis., Jan. 20, 1904.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, Ohio.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Pennsylvania Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Southwestern Electrical Association. Secretary, J. L. Ellis, Oklahoma City, Okla. Next meeting, Dallas, April or May, 1904.

Southwestern Gas, Electric & Street Railway Association. Secretary, Frank E. Scovill, Austin, Texas.

Street Railway Association of the State of New York. Secretary, W. W. Cole, Elmira, N. Y. Next meeting, Utica, N. Y., Oct. 11 and 12, 1904.

Tennessee Street Railway Association. President, C. C. Howell, Knoxville, Tenn.

United Electrical Contractors' Association of New York State. Secretary, William J. Davis, Ithaca, N. Y. Next meeting, New York City, January 19, 1904.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury, Vt.

Virginia Street Railway and Electric Association. President, R. P. Apperson, Lynchburg, Va. Next meeting, Norfolk, Va., May 15, 1904.

General News.

THE TELEPHONE.

VENTURA, CAL.—The Home Telephone Company has voted $100,000 bonds for the construction of its system in this country. The company will also erect a three-story office building in this city.

SAN BERNARDINO, CAL.—The Dale Telephone Company has been incorporated with a capital stock of $10,000 to build and operate a telephone line from Amboy to the Dale and other mining camps. The directors are H. H. Ames, F. A. Reed and J. J. Ellerman.

LOS ANGELES, CAL.—The Home Telephone Company has completed its long distance line from here to San Dimas. The Pomona Valley Co-operative Company has its line from Pomona to San Dimas almost completed. This company has over 500 subscribers and more want the service.

LOS ANGELES, CAL.—W. H. Holabird, claiming to be the lawful president of the Home Telephone & Telegraph Company, has begun suit against F. F. Graves, secretary; John M. C. Marble, president; George G. Metzger and James H. Adams, to restrain them from entering into a "pooling arrangement" that is alleged to affect the plaintiff.

DENVER, COL.—Work will soon be started on an 80-mile telephone line between Phoenix, Ariz., and Tonto, the plans for which have been prepared under the direction of the United States government hydrographic survey.

ATLANTA, GA.—The Southern Bell Telephone Company has just completed a line of six copper wires between Birmingham and Atlanta for the long distance service. Within the next six months it is said that nearly every town of any importance in Alabama will be connected with Birmingham. In Birmingham three new sections of multiple switchboard are being completed while thousands of dollars have been expended in the city for improvements.

DIXON, ILL.—The Lee County Telephone Company is contemplating rebuilding its exchange. It has 1,200 subscribers.

HOUSTON, ILL.—The Farmers' Mutual Progressive Telephone Company has increased its capital from $190 to $1500.

MARSEILLES, ILL.—The Marseilles Telephone Company has at present 250 subscribers, of which some 50 were added last year, and it is expected to increase the number to about 300 this year.

MACON, ILL.—Stromberg-Carlson apparatus is used in the exchange of the Macon Telephone Company which furnishes service to 230 subscribers at $15 a year. Mr. O. E. Daggett is manager.

CHICAGO, ILL.—The Illinois Tunnel Company has been incorporated, capital $50,000, for the transmission of sounds, signals, mail matter and merchandise. Incorporators: Chas. Wheeler, Henry A. Walkining and Thomas A. Moran, Jr. (See page 775 for further details.)

KANSAS, ILL.—Messrs. N. and C. D. Arterburn, owners of the Kansas Telephone Company, contemplate increasing their plant by about 150 telephones next year. They operate a 300-drop "American" switchboard and have 222 subscribers.

MARTINSVILLE, ILL.—With a population of 1,000 the Martinsville Telephone Company in this place is naturally proud of its record of 600 subscribers. In addition to furnishing service to the townspeople it has connections with 1,400 telephones. "American" apparatus is used. Mr. E. N. McNary is proprietor of this enterprising exchange.

ELBURN, ILL.—The Interstate Independent Telephone & Telegraph Company operates in Elburn and has branch exchanges at Kaneville and Virgil. It is now putting in a new cable of 150 pair, which gives it a capacity of 250 pairs of wires. It contemplates building a new toll line of about 25 miles to Aurora. The Elburn exchange has 204 subscribers, with prospects of an increase to 300. The rates are $12 and $24 per annum.

ORRVILLE, IND.—An independent telephone exchange has been established here by the Mt. Carmel, Ill., Independent Telephone Company.

COLUMBUS CITY, IND.—The recently incorporated Whitley County Telephone Company will extend its system over at least eight counties.

DECKER, IND.—The Home Telephone Company is building a line to connect this city with Redcloud. It is the intention to connect with the Vincennes lines.

EDWARDSPORT, IND.—The town board has granted a franchise to the Bicknell Independent Telephone Company which proposes to extend its line from Bruceville to this place. Joseph Barr is president of the company.

ALEXANDRIA, IND.—The Alexandria Telephone Company, of Madison County, has filed articles of incorporation with a capital stock of $8050. The company will build lines radiating from Alexandria throughout Madison County.

HAZLETON, IND.—Steps have been taken to organize a local telephone company at this place. The officials of the Princeton Telephone Company are encouraging the enterprise and promise the local company connections that will give it service in Princeton and as far north as Vincennes.

INDIANAPOLIS, IND.—Senator Fairbanks announces that he will take up the matter of delivery of "special delivery messages" by telephone immediately upon the convening of Congress.

FRANKLIN, IA.—The Northwestern Telephone Company has been granted a franchise for a telephone exchange in this place.

CLINTON, IA.—Articles of incorporation of the Klondike Telephone Company of Clinton township, Wayne County, have been filed. The capital is $500. D. B. Porter is president and W. A. Ockerman secretary.

ATCHISON, KAN.—The Atchison Telephone Company has petitioned the City Council for an amendment to its charter to enable the company to increase the price of its residence telephones from $1 to $1.50 per month. It

is stated that the number of subscribers has exceeded the original estimate, hence the increased cost of maintenance.

NEW BEDFORD, MASS.—The Southern Massachusetts Telephone Company has decided to install a common battery switchboard to take the place of the present equipment in this city. The company estimates that the proposed changes will involve an expenditure of from $60,000 to $75,000.

POTTERSVILLE, MICH.—An exchange of 97 telephones have just been put in operation by the Citizens' Telephone Company and a large number of additional subscribers will be connected as soon as supplies arrive.

LANSING, MICH.—The South Dover Telephone Company, of South Dover, has been incorporated with a capital stock of $1,000, and the Traverse Bay Telephone Company of Central Lake has been incorporated with a capital stock of $4,000.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company has decided to advance its rates to the maximum limit allowed under the franchise. The present rate is $20 for a residence and $30 for business telephones. The new rate will take effect January 1 and will be $24 for residences and $36 for business telephones. The company will shortly begin the installation of its new automatic system, which it is intended to have ready for operation within a few weeks.

NORTHVILLE, MICH.—The Northville Telephone Company, of Northville, Mich., has elected the following named officers for the ensuing year: Dr. J. M. Burgess, president; F. S. Neal, vice-president; R. H. Porter, secretary; E. H. Lapham, treasurer; M. A. Porter, manager; A. K. Carpenter, Dr. J. M. Johnson, W. H. Yerkes, W. G. Yerkes. The company has about thirty miles of wire and 150 subscribers. The stockholders will get a 10 per cent dividend for the past year.

WANAMINGO, MINN.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000.

BRICELYN, MINN.—The Mutual Telephone Company has been formed here to buy the local exchange. It will build a new system.

WINONA, MINN.—A 700-drop "Sterling" switchboard is operated by the Winona Telephone Company which has 750 subscribers. It contemplates building a number of rural lines. The rates are $18 and $30.

BLUE EARTH, MINN.—The Kossuth Telephone Company and the Twin City Company have agreed to extend their lines to meet at this point. This line will give access to all the principal cities and towns of northern Iowa and southern Minnesota.

PONTOTOC, MISS.—The Alabama, Mississippi & Tennessee Telephone Company contemplates the erection of cross arms and more wire from Pontotoc to New Albany, Miss., on the line to Memphis, Tenn. The company is improving its lines. At Pontotoc there are 70 subscribers, the subscription rate being $1.50 per month.

HELENA, MONT.—The Rocky Mountain Bell Telephone Company is seeking permission to build a conduit system in this city.

OSWEGO, N. Y.—The Empire State Telephone Company has let the contract for its new exchange building in this city, the price being about $15,000. The company intends to rebuild its entire system in this city.

LITTLE VALLEY, N. Y.—Six miles of farmers' lines are projected by the Little Valley Telephone Company. This company operates a Western Electric 50-drop switchboard and has 105 subscribers. The rates are $12 and $16.

DUNDEE, N. Y.—The Dundee & Tyrone Telephone Company has been incorporated. The officers are: President, G. A. Motham; vice-president, Eugene U. Bigelow; secretary, T. N. Howell, and treasurer, Philander S. La Fevre.

MALONE, N. Y.—The Franklin County Telephone Company has increased its business about one-third in the past eight months and is contemplating the building of 20 miles of toll line. There are 340 patrons of the service who pay $15 annually.

SCHENECTADY, N. Y.—A new telephone company has been organized here to construct a line from Schenectady to Princetown, thence to Delanson and Esprance. The line will be an independent one, but will have long-distance connections with the Hudson River Telephone Company's system.

NEW YORK, N. Y.—A new telephone system for the policemen on post was installed in the First Precinct of New York City last week. There are 26 telephone boxes at various points in the precinct connecting with the Old Slip Station. A bell attached to the boxes, which are placed against the buildings, may be rung from the station house and thus the officer on post may be called to the box to communicate with the sergeant or captain. Three men are detailed at the station to handle the telephone board. The precinct is divided into five sections, from which the policemen report in succeeding five-minute stretches, so that for half of each hour there is constant reporting from the men on post. Every report is entered and the sheet goes to headquarters each day. If a patrolman delays five minutes in reporting he is looked up by the roundsman and has charges preferred against him. Each policeman has a key fitting the telephone boxes. Superintendent of Telegraph Brennan established the service, and it will be spread to other precincts in the city. For several years there has been a box service for the policemen in Brooklyn, but it is not so highly developed as the one being installed in Manhattan. The patrolman can talk to the sergeant in Brooklyn by wire, but the sergeant cannot respond to the patrolman.

MONROE, N. C.—J. A. Austin and others will establish a new telephone system in Monroe.

ROCKINGHAM, N. C.—The Rockingham telephone exchange was recently destroyed by fire.

HAMLET, N. C.—The Hamlet Telephone Company has been sold to the Southern Bell Telephone Company.

ASHEVILLE, N. C.—A big petition has been gotten up here protesting against the granting of the franchise to the Bell Telephone Company.

COVINGTON, OHIO.—The Covington Home Telephone Company has increased its capital stock from $20,000 to $30,000.

ST. PARIS, OHIO.—There are 200 subscribers to the service of the St. Paris Telephone Company, which has installed American telephones.

WEST JEFFERSON, OHIO.—The West Jefferson Telephone Company has installed Stromberg-Carlson telephones and gives service to 96 subscribers. The charges are $12 and $24 per annum.

TOLEDO, OHIO.—The City Council has ordered the solicitor to commence action to prevent the Home Telephone Company of this city from increasing its rates in alleged violation of its franchise.

CINCINNATI, OHIO.—The Cincinnati & Suburban Bell Telephone Company has closed a contract with the Owenton Telephone Company, of Owenton, Ky., which will give service from all points in Owen County, Ky., to this city.

WASHINGTON C. H., OHIO.—The Washington Home Telephone Company has American Electric apparatus and 900 subscribers. It has 100 miles of toll lines. From $12 to $24 per annum is charged, according to the class of service.

RICHWOOD, OHIO.—The addition of 12 miles more of farmers' lines is under consideration by the Richwood Telephone Company, which has at present 300 subscribers, operating North and Stromberg-Carlson instruments. The rates are from $1 to $2 per month.

XENIA, OHIO.—An exchange at Bowersville is projected by the Springfield-Xenia Telephone Company and also the building of a number of party lines. The Xenia exchange has 850 subscribers, to whom charges are made for business $2 and for residence $1 per month.

SIDNEY, OHIO.—Several country lines will be built by the Sidney Telephone Company, which now has 782 subscribers, 98 miles of toll line and uses "American" apparatus. It informs us that the outlook is very flattering for a most prosperous year, with many new subscribers to be added and this in spite of the increase made in the rates in January.

WESTON, OHIO.—Eighteen months ago the Weston Home Telephone Company began business and it now numbers 135 subscribers, with a looked-for increase to about 175. Connections can be had with Hamler, Malinta, Westhope, McClure, Grandiapida, Tontogany, Haskim, Holgate and Grelton, Ohio. The company plans to run a toll line to Milton Center and Custas, Ohio.

SANDUSKY, OHIO.—The Sandusky Telephone Company has a 2,400-drop North switchboard through which service is furnished its 1,200 subscribers. The system has grown at the rate of 150 telephones per annum. The charges are $18 and $30, "but it is evident we will soon be obliged to increase our rates and institute party lines and measured service," Manager Curtis states.

RAVENNA, OHIO.—The Portage County Telephone Company operates a 200-drop switchboard at Garrettsville, 140-drops at Mantua, 1,000 at Kent and 560 at Ravenna. North and Eureka apparatus are used. There are now 50 miles of toll lines and it contemplates adding 30 miles more. Mr. Allen Seiberling tells us that the telephone business is growing faster than cash can be obtained to take care of it.

TIFFIN, OHIO.—The Home Telephone Company reports that it has never been able to take care of the increase in the business and could have 1,500 telephones working (present number 975) if it could supply all the applicants. With the installation of a new switchboard of 2,000 drops individual residence service will be advanced to $18, giving a four-party line selective service at $12. The company expects to have 1200 telephones within the next six months.

OTTO, OKLA.—The Perry & Otto Telephone Company has been incorporated with a capital stock of $500. The incorporators are G. Reuple, T. J. Smith, J. H. Baird and others.

CARNEGIE, PA.—The Gayly Local Telephone Company has been incorporated with a capital stock of $5,000.

STEELTON, PA.—The United Telephone & Telegraph Company will soon start work on the erection of a new brick exchange building.

INDIANA, PA.—The Indiana Telephone Company has decided to spend an additional $5,000 in finishing the Saltsburg line and in general improvements to the company's system.

MT. AIRY, S. C.—The Bell Telephone Company will build a long distance line from Winston-Salem to Mt. Airy.

BOWDLE, S. D.—The Dakota Central Telephone Company has 49 subscribers, all of whom use North apparatus. A new metallic copper line from Bowdle to Aberdeen was recently completed.

FLANDREAU, S. D.—A 50-drop section board and some farmers' lines are proposed by the Flandreau Telephone Company, of which Mr. W. A. Simpson is manager. The company uses Standard Telephone & Electric Company's apparatus, and has 125 subscribers.

CHATTANOOGA, TENN.—The stockholders of the Hamilton Telephone & Power Company have elected the following named officers: President, Z. C. Patten; vice-president, C. D. Mitchell; secretary, E. Y. Chapin; treasurer, M. Llewellyn. Directors: Z. C. Patten, L. J. Sharp, H. S. Chamberlain, Charles Rice, C. D. Mitchell, J. N. Trigg, E. Y. Chapin.

AUSTIN, TEX.—The Fort Worth Telegraph Company has increased its capital stock from $304,000 to $450,000.

LOGAN, UTAH.—The Rocky Mountain Bell Telephone Company is arranging to construct a new building early next spring. The structure will be two stories high.

FARMVILLE, VA.—The council has granted permission to the South Side Telephone Company to establish an office in this city.

FAIRHAVEN, WASH.—An effort is being made to raise sufficient funds for the construction of a telephone system to San Juan island. The scheme is being promoted by the governing board of the commercial club of this city.

ELECTRIC LIGHT AND POWER.

YREKA, CAL.—The Siskiyou Electric Light & Power Company has purchased a site in this city on which to erect a transformer building for transmitting power in Yreka.

LOS ANGELES, CAL.—The franchise granted by the Board of Supervisors to Reuben Hart several months ago to construct and maintain wires and conduits for the transmission of electrical energy for light and power purposes along the streets of Santa Maria and adjacent territory, has been sold to the Machinery and Electrical Company, of Los Angeles. A four-months' extension of time has been granted to the Los Angeles concern.

LOS ANGELES, CAL.—According to a recent statement of chief engineer, B. L. Davis, of the Kern River Power Company, formerly the Edison Light & Power Company, the company will build a transmission line from Kern River to this city, a distance of 160 miles. It is stated that this will be the heaviest transmission line in the world. The line will be supported upon iron towers 60 feet high and 700 feet apart. The towers are designed to carry cables, wires and wire conduits, and 1300 of them will be required. Power will be transmitted at 100,000 volts and will be available at different points for lateral connections. The transmission system will cover Southern California.

DENVER, COL.—The Routt County Electric Light Company has been incorporated with a capital stock of $125,000. Mr. J. B. Waterbury is one of the directors.

COEUR D'ALENE, IDA.—The Town Trustees have granted the Consumers' Company a franchise for water works and a lighting system.

BLACKFOOT, IDA.—This city is now lighted by electricity, transmitted a distance of 50 miles from the plant at American Falls, by way of Pocatello.

BOISE, IDA.—Parties representing Senator W. A. Clark, of Butte, Mont., have laid before the state engineer plans for the diversion of water from the falls at Shoshone and the construction of an immense power plant at a cost of about $5,000,000. If the necessary concessions are secured by the promoters the plant will be by far the largest in the western territory. Power, it is planned, will be distributed from this point as far south as Ogden and Salt Lake City, Utah. The company also contemplates the construction of an electric road from Boise to the Boise basin.

CARDIFF, ILL.—The Coal Company is said to be contemplating putting in an electric light plant, and furnishing light to the village.

VIOLA, ILL.—The Viola Electric Light Company has been incorporated; capital, $6000. Incorporators: T. F. Sexton, A. C. Bradford and L. J. Sexton.

KENTLAND, IND.—The electric light plant of this city, owned by George D. Rider, was totally destroyed by fire Oct. 23. The loss is $8000 with no insurance. The plant will be rebuilt at once. Mr. Rider wants bids for the construction of the new plant.

INDIANAPOLIS, IND.—James B. Nelson, who was city engineer during the last city administration, has been appointed manager of the Merchants' Lighting & Heating Company of this city.

INDIANAPOLIS, IND.—Dr. S. C. Dickey, manager of the Technical Institute, is preparing to ask for bids for the construction of a power house and an electric light plant on the institute grounds in this city.

CONNERSVILLE, IND.—The General Electric Light & Power Company, of this city, has gone into the hands of a receiver. J. C. Mount has qualified as receiver under bond of $100,000. The trouble arose over a suit to recover interest on twelve $500 bonds which had defaulted.

DAVENPORT, IA.—The Davenport Water Power Company, it is stated, intends to revive a plan for supplying water power from the Iowa side of the Mississippi River. This development has been proposed at intervals for ten years past, and it is now stated that the project has taken shape in the form of a bill which will be presented to Congress for the purpose of acquiring the necessary rights.

DAVENPORT, IA.—The Electric Construction & Machinery Company, of Moline, Ill., has secured the contract for the general electric equipment at the new shops of the Rock Island Railway Company. The contract calls for 146 arc lamps, 3500 incandescent lamps and 121 motors, to be furnished and placed in position; also wiring for connections with motors. The contract price is reported to be $32,000.

HARRODSBURG, KY.—Electric light bonds amounting to $18,000 have been sold.

HOLYOKE, MASS.—The Holyoke Water Power Company has transferred to the Whittmore Mfg. Company the plant, site and water power rights at the corner of Canal and Appleton Streets in this city. The price paid for the plant was in the neighborhood of $75,000.

BOSTON, MASS.—The Worcester South Electric Companies, of Boston, Mass., has been incorporated with a capital stock of $200,000. The incorporators are: President, Thomas Reed; treasurer, Henry F. Knight, and clerk, Arthur E. Newhall. The purpose of the corporation is to aid in the incorporation, organization and development of electric light, electric power, gas, water, water-power, railroad, railway, telephone, telegraph and manufacturing companies.

DETROIT, MICH.—Mr. George W. Winterhalter has secured the contract for laying 3250 feet of electric light conduits in this city.

TRAVERSE CITY, MICH.—The plant and franchises of the Traverse City Gas Company have been purchased by the owners of the Boardman River Electric Light & Power Company.

MONROE, MICH.—The 300-hp. compound engine in the municipal lighting plant in this city collapsed recently and was much damaged. It is stated that it will require a month's time and an expenditure of over $2,000 to repair the damage, and in the meantime the city will be without electric light. There is a second engine in the plant, but it is in such shape that it cannot be used.

SOUTH STILLWATER, MINN.—The citizens have voted to issue $15,000 bonds for an electric light plant and bids for the bonds will be received Nov. 21.

HANNIBAL, MO.—George A. Damon, of Chicago, is in Hannibal inspecting the municipal electric light and power plant to make recommendations for the board of public works for the perfection of the plant and to furnish an estimate of the cost of improvements. A plan for the rebuilding of the entire plant is being considered.

FLORENCE, NEB.—The City Council has granted a franchise to the Omaha Electric Light & Power Company for 25 years and has entered into a five-year contract for five arc lights on Main Street and twenty incandescents on the side streets. The company has already begun to extend its lines from Omaha and within a very short time the work will be completed. The series-alternating arc lighting system will be used.

NEWARK, N. J.—The Block Light Company, of Nebraska and Kansas, to deal in electric lighting plants has been incorporated here; capital, $100,000. Incorporators: Charles A. Murphy, Frederick H. Porter, William W. Shaw, Gardner W. Kimball, James B. Richardson.

BATAVIA, N. Y.—The gas & electric plant of the Consolidated Gas & Electric Company has been turned over to the Consolidated Industries Company of New Jersey, which latter concern will operate the local plant in the future.

SYRACUSE, N. Y.—The following-named officers of the Syracuse Lighting Company were elected at the recent meeting: President, Ceylon H. Lewis; vice-president and treasurer, John J. Cummins; secretary, Louis L. Waters, all of Syracuse.

NEW YORK, N. Y.—The Improved Electric Light & Heat Company, of New York City, has been incorporated with a capital stock of $10,000. The directors are John Knobloch and G. K. Hartung, of New York City, and G. W. Wallance, of Mt. Vernon.

PORT JEFFERSON, N. Y.—The Central Long Island Electric Light Company, of Port Jefferson, has been incorporated; capital, $5000. Directors: Chas. R. Mitchell, of New York City; D. McN. Niven, of Montclair, N. J., and A. S. Niven, of Glen Ridge, N. J.

DEFIANCE, OHIO.—The Peoples' Gas & Electric Company, of Defiance, has increased its capital stock from $100,000 to $150,000.

PRAIRIE DEPOT, OHIO.—Owen King, owner of the electric lighting plant at this place has offered to sell the plant to the town for $5,000. Mr. King claims that he is now running the plant at a loss.

COLUMBUS, OHIO.—It is stated that the report of Mr. E. F. Brown, state examiner, who has just completed an investigation of the records of the City of Hamilton, will not be favorable to municipal ownership of the gas and electric light industries. The average annual cost for each arc light per annum to the Hamilton tax-payers, according to Mr. Brown's figures, has been $99.43 and of gas lamps $45.

GUTHRIE, OKLA.—The Shawnee Light & Power Company, of Denver, Col., has been granted a territorial charter with $200,000 capital. The incorporators are Edith Paulson, Otto Dappler, D. J. McCann and others, all of Denver, with C. E. Jackson, of Shawnee, Okla., as territorial agent.

MARYSVILLE, PA.—The Marysville Electric Light Company has been incorporated with a capital of $10,000.

PITTSBURG, PA.—The East McKeesport Light Company has been incorporated with a capital stock of $50,000.

HARRISBURG, PA.—Local press reports state that the Pennsylvania Railroad Company is to construct a plant to provide its yards with light and power.

SCRANTON, PA.—The contract for electrical equipment in the Almshouse at Hillside Home has been awarded to H. B. Coho & Company, New York, for material and labor, $11,375.

ERIE, PA.—Architect Engstrom, of Philadelphia, has completed plans for the new power house to be built south of Waterford by the Erie, Cambridge, Union & Corry Traction Company.

MILLER, S. D.—Stephen Pauly is interested in the construction of an electric light plant.

WESSINGTON SPRINGS, S. D.—J. B. Collins is stated to have secured a franchise for an electric light plant.

HOUSTON, TEX.—The Houston Light & Power Company will expend about $200,000 in improvements and extensions.

PITTSFORD, VT.—The Chittenden Power Company is preparing to erect a power house near East Pittsford, Vt. French & Bryant, of Brookline, Mass., are the engineers.

RICHMOND, VA.—E. E. Davis, Secretary of the Committee on Water, writes that new bids will be received on Nov. 16 for furnishing material and erecting an electric power plant, including steam, hydraulic and electric machinery of 200-hp capacity; also two electrially operated pumps of 1000 gallons capacity per minute each; also for erecting an annex to new pump house.

NEWPORT, WASH.—The Council has granted J. C. Odell and associates a franchise for an electric light plant.

OLYMPIA, WASH.—The City Council has passed an ordinance granting a franchise to Gordon Mackay and others to furnish electric light and power.

ROE, W. VA.—It is reported that the Hughes Creek Coal Company proposes to purchase an electric power plant. Mr. J. W. Moore is manager.

WITTENBERG, WIS.—The citizens have voted to issue $8000 bonds for a municipal electric light plant.

KILBOURN, WIS.—Steps are being taken to rebuild the dam to furnish electric power. P. L. Spooner is interested.

THE ELECTRIC RAILWAY.

EUFAULA, ALA.—A franchise has been granted to the Eufaula Railroad Company. The company is composed of J. P. Foy, B. B. McKenzie, R. A. Ballowe, C. A. Martin, H. C. Holleman and L. H. Brassell. It is proposed to construct a system of electric lines over the city and to extend it as far as Abbeville.

TORRINGTON, CONN.—At the annual meeting of the Hartford-Torrington Tramway Company the following officers were elected: President, M. C. Webster, of New Britain; vice-president, Walter Holcomb; treasurer, N. E. Pierce, of Bristol; secretary, D. B. Mansfield, of Harwinton.

MOUNT VERNON, ILL.—Isaac A. Smith, chief engineer for the Southern Illinois Electric Railway Company, has finished the drawings for the main power house of the road, which will be located at Irvington.

CHICAGO, ILL.—The Chicago Railways Company has been incorporated to operate street railways in the counties of Cook, Lake, McHenry, DuPage and Will; capital, $10,000. Incorporators: N. C. Johnson, Wm. E. Cooper and Archibald Thistleton.

ROCKFORD, ILL.—The Inter-State Electric Railway Company, which was incorporated some weeks ago for the purpose of building a line from Rockford to Madison via Brodhead, has been formally organized at Rockford. President, M. A. Beal, manager, Rockford Edison Company; vice-president, N. F. Thompson, vice-president Manufacturers' Bank.

FRANKFORT, IND.—The Indianapolis & Northwestern Traction Company has the road now completed between Lafayette and Dayton. Construction trains are now running back and forth. The connection between the interurban and the street car company's tracks will not be made for a few weeks.

LOGANSPORT, IND.—The Union Traction Company has announced that the line being built from Anderson to Newcastle paralleling the Pennsylvania Railroad system will be abandoned, although much of the grading has been done and the right of way for a distance purchased. The action was taken owing to the exorbitant prices set on land in the Sugar Creek bottoms south of Anderson.

INDIANAPOLIS, IND.—The Indianapolis, Shelbyville & Southeastern Traction Road has been sold by Fletcher Hines and Dr. R. C. Light to the traction interests headed by Charles L. Henry. The consideration was about $8,500,000. New officers were elected, George A. Ball, of Muncie being made president. It is announced that the extension from Shelbyville to Greensburg will be pushed through.

IOWA CITY, IA.—Articles of incorporation of the Iowa City, Davenport & Muscatine Railway Company were filed with the Secretary of State. The capital stock of the company is $1,500,000. The line will be about 60 miles in length. Motive power will be electricity, steam or compressed air. It is intimated that this line is to be a link in the Des Moines-Chicago electric line now projected. The company is empowered to manufacture and distribute and sell electricity for light, heat and power purposes. The incorporators are: Milton Remley, Stephen Bradley, H. R. Berry, E. J. Spencer, Thomas W. Crouch, L. S. Mitchell and L. B. Pierce. At a meeting of the stockholders in Iowa City, Oct. 16, the following officers were elected: H. R. Berry, of Iowa City, president; T. W. Crouch, of St. Louis, vice-president; Milton Remley, of Iowa City, secretary; L. S. Mitchell, of St. Louis, treasurer.

JUNCTION CITY, KAN.—The Junction City Electric Railroad, Light & Ice Company, of Junction City, has filed an amendment to its charter increasing its capital stock from $100,000 to $300,000. Numerous improvements are contemplated.

BALTIMORE, MD.—The city solicitor of Baltimore, Md., has been authorized to institute legal proceedings against the United Railways and Electric Company for the occupancy of the city conduits which the company has been utilizing for 18 months. It is said, however, that the company will make a further proposition to the city.

WESTFIELD, MASS.—The Woroneo Street Railway Company has enlarged its power house in order to provide for an additional generator.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company plans to build in the spring a new line between Worcester and Leominster.

GREENWOOD, MISS.—The City Council of Greenwood has granted a 50-year franchise to the Greenwood Electric Railway Company which contemplates building an electric railway system which eventually may be extended to a number of nearby towns.

SOUTH OMAHA, NEB.—It is announced that a new railway company, to be financed and operated by South Omaha men and to be known as the Omaha & Southern, will be incorporated within a few days. The road will run from South Omaha to Papillion. It is to be capitalized for $250,000. The incorporators are Messrs. B. E. Wilcox, Z. Cuddington, A. C. Tully, John J. Ryan, Lyman Waterman and Charles E. Miller.

SCHENECTADY, N. Y.—The Schenectady Railway Company has received authority from the State Railroad Commission to increase its capital stock from $600,000 to $7,000,000. The increased capital to be used for the absorption of the stock of the Mohawk Gas Company, of Schenectady.

ROME, N. Y.—At a meeting of the directors of the Rome City Street Railway Company, the following new officers and directors were elected: President, Horace E. Andrews; vice-president, John J. Stanley; treasurer, Charles B. Rogers; secretary, Walter N. Kernan. Directors: William E. Lewis, C. Loomis Allen, Nicholas L. Devereux.

NEW YORK, N. Y.—According to a special despatch from St. Paul, the United States Steel Corporation management is considering the feasibility of operating by electricity its ore-carrying railroads in Minnesota and the mines on the ranges; and an inspection of these properties has recently been made by a party of United States Steel officials and representatives of the General Electric Company and the Westinghouse Electric & Manufacturing Company.

UTICA, N. Y.—At the annual meeting of the Oneida Railway Company the following officers were elected: President, Horace E. Andrews, Cleveland; vice-president, John J. Stanley, Cleveland; secretary, Walter N. Kernan, Utica; treasurer, Charles B. Rogers, Utica; assistant secretary, A. L. Linn, Jr., Utica; general manager, C. Loomis Allen, Utica. Directors: Messrs. Andrews and Stanley, of Cleveland; Kernan and Rogers, Utica; A. M. Young, New York; R. E. Drake, Syracuse, and H. C. Stone and Hon. E. L. Hunt, Oneida.

ZANESVILLE, OHIO.—The Southeastern Ohio Railway, Light & Power Company has organized with the following officers: M. W. Hissey, president: Frank Ransbottom, vice-president; E. R. Meyer, secretary-treasurer and general manager. The company proposes to build an electric railway from Zanesville to Crooksville and ultimately to extend to New Lexington.

AKRON, OHIO.—The directors of the Northern Ohio Traction & Light Company have authorized the extension of the line from Akron to Massillon. This line was proposed over two years ago, and about $65,000 was spent in securing right of way and grading so that a portion of the route is ready for the rails. Work was stopped where the company secured control of the Canton-Akron Railway, which also touched Massillon. At the time of the Everett-Moore embarrassment the Canton-Akron Railway reverted to the former owners. Now that the Massillon line is to be completed the Northern Ohio Traction & Light Company will enter into competition with the Canton-Akron Railway.

PORTLAND, ORE.—The Portland Railway Company is to construct a new railway down the Peninsula.

JOHNSTOWN, PA.—There is a movement on foot for the building of an electric railway from Johnstown to New Florence.

PLYMOUTH, PA.—The Township Commissioners have granted a franchise to the Berwick & Nanticoke Street Railway Company.

JEANNETTE, PA.—Rights of way have been secured and surveys are being made for an electric railway from Jeannette to West Newton, which will ultimately be extended to Webster.

IRWIN, PA.—A charter has been issued to the Irwin & McKeesport Railway Company, capital $45,000, to build a line 7½ miles long from Irwin to Fawcett, Allegheny County. John George is president.

HAWTHORNE, PA.—The Bethlehem & Hawthorne Street Railway Company, $36,000 capital, has been chartered to build a 6-mile line from South Bethlehem to New Bethlehem and Hawthorne. W. S. Cox is president.

ALLENTOWN, PA.—Rights of way are being secured for an electric railway from Macungie to East Texas, which will connect with the Allentown-Reading line at Macungie. The Reading Traction Company is trying to extend its line along the East Pennsylvania Railroad.

LANCASTER, PA.—A charter has been granted the Lancaster & Southern Street Railway Company, capital $84,000, to build a 14-mile line from Martic Forge to Westhook station. The officers are James G. McSparran, president; William Wohlsen, vice-president; T. K. Worthington, secretary and treasurer.

ERIE, PA.—Capitalists of this section have formed a company for the purpose of going ahead with the preliminaries incident to the building of the Northeast, Findley Lake & Corry Electric Railway. These officers have been elected: G. W. Blaine, president; E. E. Chambers, president of executive committee; A. I. Loop, secretary.

MEMPHIS, TENN.—The Shelby County Traction Company is seeking right of way for a direct electric railway from Memphis to Colliersville. Judge T. J. Latham is among those interested. The new company proposes to furnish electric lights to farmers along the route. The new company is prepared to begin work in a few weeks provided all preliminaries are arranged satisfactorily.

HOUSTON, TEX.—It is stated that Stone & Webster, of Boston, Mass., who own the electric street railway system here contemplate extensive improvements. D. G. E. Tripp, of Boston, has been investigating the situation here.

TEMPLE, TEX.—The project of building the interurban electric railway between Belton and Temple has been revived and it is said that the prospects are now favorable for the early construction of the line. R. T. Crawford, of Temple, can give information.

SHERMAN, TEX.—It is reported that a syndicate of Boston capitalists, represented by William Netherhurt, a civil engineer, are investigating the situation with the view of building an interurban electric road between this city and Dallas by way of McKinney and also to build a line between this city and Fort Worth.

HOUSTON, TEX.—W. E. Scott, of the Houston-Galveston interurban electric railway, says that the work of constructing the line will commence in about three months. The articles of incorporation of the company will soon be filed for record in the Secretary of State's office at Austin. It is the purpose of the company to first construct the line between Houston and Galveston and thereafter build the branch line to La Porte.

SPOKANE, WASH.—Arrangements are being made in New York for the placing of the bonds of the company which will construct an electric railway between Huntington, in this state, and Lewiston, Ida. M. O. Reed, president of the company, writes from New York that the project has been favorably considered by eastern capitalists and that work will commence on the road early in the spring.

NEWPORT NEWS, VA.—The charter of the Hampton Roads Railway & Electric Company, of Newport News, has been extended for three years and the capital stock increased from $50,000 to $500,000.

MERIDA, MEX.—The legislature of this state has granted a concession to Fernando Cervera and G. Rojen for the construction and operation of a street railway line between Yaxcopoil and the town of Chocola.

NORFOLK, VA.—The control of the Chesapeake Transit Company, operating an electric road from Norfolk to nearby points, has passed into the hands of A. H. Flint, of New York, who was elected president of the road.

CHARLESTOWN, W. VA.—A charter has been issued to the Paden City, Middlebourne & Salem Railway Company, of Paden City, to construct and operate an interurban railway system through these cities, with a capital of $100,000. The incorporators are Thomas A. Watkins and George R. Wallace, of Pittsburg, Pa.; Robert Miller, of Paden City, W. Va.; George E. Work, of Sisterville, W. Va and F. L. Robinson, of New Martinsville, W. Va.

NEW INDUSTRIAL COMPANIES.

THE JANDUS ELECTRIC COMPANY, of Cleveland, Ohio, has been incorporated; capital, $100,000; capital in Illinois, $2500.

THE ROBERTSON ELECTRIC COMPANY, of Buffalo, N. Y., has increased its capital stock from $20,000 to $50,000.

THE AMERICAN ENGINEERING & EQUIPMENT COMPANY, New York, has been incorporated; capital, $250,000. Directors: F. M. Ashley, A. H. Broza, and J. M. Birnbaum, New York.

THE FISH & HORTON COMPANY has been incorporated at Rochester, N. Y., to install electric lighting plants. The capital stock is $10,000, and the incorporators are Fredk. Fish, Minaz S. Horton, Emma F. Fish, of Rochester, N. Y.

THE RADIO HEAT & POWER COMPANY has been incorporated in the District of Columbia at Washington with a capital stock of $200,000. The names of the incorporators are L. A. White, R. K. Van Mater, W. C. Dashiell and Edwin Bradford.

THE EMPIRE CONSTRUCTION COMPANY has been incorporated at Santa Rosa, Cal. Senator W. A. Clark, of Montana, and ten others are the incorporators. The company is organized to construct railways, telephone lines, etc., with a capital stock of $1,000,000.

THE SCOTT SNELL LIGHTING COMPANY, of New York City, has been incorporated in New Jersey to manufacture lamps and lighting apparatus. The capital stock is $250,000, and the incorporators are S. B. Timmins, A. B. Eilback, New York City, and Chas. Schegel, Jersey City.

THE ELECTRIC PROTECTION COMPANY has been incorporated at Trenton, N. J., with a capital stock of $3,000,000. The company proposes to manufacture electrical burglar-proof vaults. The incorporators are John R. Williams, W. W. Miller and Charles A. Sitler, Camden, N. J.

LEGAL.

INJURY FROM TELEPHONE WIRE.—The Michigan Telephone Company, in stringing a wire around an angle in a street, erected a guy wire to stay the pole at one end of the elbow to prevent the pole being drawn over and the wire sagging. The guy wire was fastened near the top of the pole, and extended to another pole, between the sidewalk and the curb, fastened about ten feet from the ground, crossing above the pavement. A man was injured by his wagon coming in contact with the wire, the wire having then sagged to within a few feet of the ground. The telephone company contended on the trial of an action for damages brought by the injured man that the sagging was due to an exceptionally severe storm, which had been very destructive to poles and wires within the city, and that it had procured all the help possible in addition to its regular employees to repair the damage, and that it had no notice of the sagging of this particular wire. It was held by the Michigan Supreme Court that defendant's negligence and plaintiff's contributory negligence were questions for the jury.

JOINT LIABILITY FOR BROKEN WIRE.—In the appeal case of the Economy Light & Power Company, et al versus Hiller, the Supreme Court of Illinois held that where the wires of an electric light company charged with a powerful current crossed above the wires of a telephone company, not of themselves dangerous, but left uninsulated, and the poles and supports of the electric light wires were neglected, there was a joint liability for personal injuries received from a telephone wire charged by contact with a sagging electric light wire, and they might be joined in suit therefor. There was evidence tending to show that the Chicago Telephone Company would probably know when its wires were burned out or its system interfered with, and after the wire was burned out in the night time, and was hanging in a dangerous condition in a public street, nothing was done to repair the damage or remove the danger at 8:30 o'clock the next morning, when the accident occurred. It was held that the court could not say, as matter of law, that proper inspection and diligence on the part of the telephone company did not require it to discover the dangerous condition and remove the danger to those using the street before that time.

WATER POWER CONDEMNATION.—In upholding the judgment of the Circuit Court of Will County, in the Gaylord water power condemnation case, the Supreme Court of Illinois lays a doctrine regarding the statute of 1872, under which Gaylord sought to acquire the water power at Joliet, created by Sanitary District Canal. The following is an excerpt from the decision: "We are clearly of the opinion that in so far as the statute of 1872 attempts to authorize the condemnation of private property for the purposes of public mills or machinery other than public grist mills, it is violative of that provision of our constitution which declares that private property shall not be taken or damaged for public use, without just compensation, the meaning of which is that private property shall be taken for no other than a public use, and then only on the payment of just compensation, and that on these grounds alone, the Circuit Court would have been justified in sustaining motion to dismiss appellant's petition." The Gaylord syndicate has sued to seize the power under the plea that is was about to build a grist mill, as provided in the statute. By the Sanitary District it was contended that the property had already been put to public use in carrying off sewage of the City of Chicago, and was about to put it to still further use by constructing a water power of its own.

OBITUARY.

RODERICK H. WEINY, a well-known telegraph engineer, of New York, was stricken with apoplexy on October 31 and died the next day. At the time of his death he was in the service of the American Telephone & Telegraph Company as telegraph expert and special agent to the general superintendent. Deceased was 45 years of age. The funeral took place on November 2 in Glen Ridge, N. J.

JOHN C. DANIELS.—We regret to record the death of Mr. John C. Daniels, of the Garton-Daniels Company, manufacturers of lightning arresters and other electrical specialties at Keokuk, Iowa. He died on October 25 at his former home in Eau Claire, Wis., whither he had gone in the hope of securing relief from his disease. He was formerly owner of a fleet of raft boats on the Mississippi, in the days when commercial navigation on the great river was more important than now; but since 1892 he had been connected with the company above named. Born in New York State in 1840, Mr. Daniels was therefore 63 years old. He was a man of sterling worth and character and deserved to be more widely known personally than he was in the electrical field, especially as the apparatus bearing his name has so long enjoyed a widespread reputation.

PERSONAL.

MR. JACOB WENDELL, JR., of Wendell & MacDuffie, Havemeyer Building, has returned from a trip to Europe.

MR. S. B. CONDIT, JR., of Boston, Mass., was in New York last week in the interests of S. B. Condit, Jr., & Company.

MR. W. B. BOURN, the president of the San Francisco Gas & Electric Company, is, it is reported, to receive a salary of $25,000 per year.

BROWN-MILLER.—The marriage is announced of Mr. Joseph Stanford Brown, well known in electrical circles, to Miss Frances Baldwin Miller, of New York City.

MR. J. A. MUIR, general manager of the Los Angeles Railway Company, has been elected to the directorate of the Pacific Light & Power Company, of Los Angeles, Cal.

MR. J. M. MARTIN has resigned his position as district sales agent at the Philadelphia office of the Nernst Lamp Company, and Mr. A. E. Baker has been appointed as his successor.

MR. B. MAGNUS, superintendent of the electrolytic refinery and silver mill of the Anaconda Copper Mining Company will shortly leave Montana, and expects to be located in the East.

MR. CHARLES T. BISHOP, formerly with Ladenburg, Thalman & Company, New York, and late paymaster U. S. Navy, has been appointed auditor of the H. W. Johns-Manville Company, of New York City.

DR. HANS GOLDSCHMIDT, the discoverer of thermit, will deliver a lecture at Columbia University, Friday, Nov. 13, during which he will demonstrate experimentally some of the remarkable properties of the new heat agent.

MR. MYRON T. HERRICK, the banker and street railway leader of Cleveland, has been elected Republican governor of Ohio by 100,000 majority. His opponent was Mr. "Tom" Johnson, also known once as a street railway manager of large fortune, but now prominent as an advocate of low fares.

COL. N. H. HEFT.—It is stated from New Haven, Conn., that the return of Col. Heft, general electrical manager of the New Haven Road and principal stockholder in the New York and Stamford Tramway Company, from Europe, has revived the rumor that the Consolidated is to take over the smaller property.

MR. CHARLES M. CLARK presented a paper on telpherage before the Institute of Electrical Engineers last year. This has now been reprinted with revisions by the author, by the Smithsonian Institution of Washington, D. C., in the Smithsonian Report for 1902 and more recently in separate pamphlet form.

MR. W. C. ESCHER, of the Swiss engineering firm of Escher, Wyss & Company, of Zurich, is now on a visit to this side. His firm, as noted in these columns at the time the contract was placed, are building large turbines for installation in the Necaxa plant of the Mexican Light & Power Company, Limited.

MISS EDITH AYRTON.—It is announced by cable that Miss Edith Ayrton, daughter of Prof. W. E. Ayrton, is to marry Mr. Israel Zangwill, the well-known English novelist and dramatist. Both of them have visited this country. Miss Ayrton has also marked literary ability and has been a contributor to "Lippincott's Magazine," the "Westminster Gazette," and other periodicals.

MR. GEORGE W. McELHINEY, of Guanajuato, who is largely interested in the Guanajuato Electric Light & Power Company and several mining properties in Mexico which are to be electrically operated, is now in New York at the Waldorf-Astoria, and at the offices of William P. Bonbright & Company, 15 Wall Street.

MR. JAMES F. CUMMINGS is now in St. Petersburg, Russia, superintending the laying of Yankee conduit for the municipal telephone and telegraph lines. He has employed over 2000 Russians to carry out the work. The conduit is being shipped from the plants along the Raritan River, N. J., of the American Vitrified Conduit Company.

MR. ALFRED SKITT, of the Manhattan Elevated, has been inspecting the traction systems in Chicago, with a view, it is rumored, to buying out all the Elkins-Whitney-Widener interests there on behalf of new capital. Mr. Skitt

is himself an old street railway man, having been manager of the old Vanderbilt Fourth Avenue system. Details of this move are given in our Financial intelligence.

MR. J. M. SMAIL, C. E., engineer-in-chief of the Metropolitan Board of Water Supply and Sewage, Sydney, Australia, is visiting this country on his way home from England. Besides visiting water works and sewage plants while here, he has been looking into electrical matters, such as pumping, etc., and has visited some of the leading electrical factories. He will proceed over the Canadian Pacific to Vancouver.

MRS. T. A. EDISON gave a notable Halloween party at Llewellyn Park, Orange, last week, where electricity was enlisted by the "Wizard" himself for some new sensational effects appropriate to the occasion and worthy of imitation elsewhere. Mr. W. J. Hammer exhibited and discussed radium as one of the new sources of light by which a girl can see the face of her future husband and even read his mind if he has one.

PROF. W. E. AYRTON, F. R. S., who has been visiting this country as a member of the Mosely Educational Commission, sailed for home last Saturday. His stay was all too short for the work in hand, as well as for the friends who wished to see him and the things he wished to inspect in the field of electricity. Besides studying education in New York, Prof. Ayrton went to Washington and other cities. The calls for him from his professional engagements in England were too pressing, however, to be denied.

MR. ANDREW CARNEGIE and family returned home to New York last week on the White Star liner *Cedric*, in good health. He will spend the winter at his new Fifth Avenue home. Interviewed as to the financial outlook, he said: "It is a good thing to have some of the water squeezed out of some of the stocks which are now on the market. It will not hurt the standard securities, they are as good as ever. The recent turn of affairs in Wall Street will have as a result the salutary reduction of values, and everything will be brought to a healthy condition."

MR. HENRY S. SNOW.—We regret to note that Mr. Henry Sanger Snow has tendered his resignation as President of the Polytechnic Institute, Brooklyn. His action is based on a desire to be relieved of the administrative cares of the institute. He has been the head of the Polytechnic since July 1, 1899. He has been re-elected Chairman of the Board of Trustees of the institution. A special committee has been appointed to select his successor as president. Mr. Snow has a great many financial interests to look after, including those of the New York & New Jersey Telephone Company.

MR. F. S. PEARSON left for Mexico Oct. 31 in connection with the undertaking of the Mexican Light & Power Company, of which he is vice-president. Mr. F. O. Blackwell, formerly chief engineer of the power and mining departments of the General Electric Company, is chief engineer of the Mexican Company. He is now in the southern republic. Mr. J. M. Neilson, the managing director of the company, has left Montreal, where its head offices are, for Mexico. Mr. James Ross, of Montreal, the president of the company, is expected to make a visit to Mexico about the latter part of this month.

MR. JAMES STEWART, of the American contracting firm of James Stewart & Company, of Pittsburg, St. Louis and London, who as constructing manager of the British Westinghouse Electric & Manufacturing Company's plant at Trafford Park, near Manchester, worked such wonders, sailed for Europe Oct. 31, after a short visit to this side. Mr. Stewart is now primarily engaged in the supervision of the construction of the huge Chelsea plant which is to operate the Yerkes underground roads in London and vicinity. The British Westinghouse people have the contract for the construction and equipment of the plant.

MR. ARTHUR WILLIAMS, whose contribution to the programme of the Chicago meeting of the National Electric Light Association will be remembered as one of the most interesting items, has kindly consented to continue in charge of the department of sign and decorative lighting and to prepare another report on the subject, to be presented at the next convention, to be held in Boston in May or June. When so busy a man as Mr. Williams gives the time and thought necessary for making such elaborate reports two years in succession, it shows that he has the interests of the association very much at heart and all the members are under great obligations to him. Through the kind co-operation of the New York Edison Company, Mr. Williams' last report, handsomely printed with colored illustrations, was distributed without expense to the association, enough extra copies being furnished to bind the book of proceedings.

Trade Notes.

CROSS OIL FILTERS.—The Tennessee Coal, Iron & R. R. Co. has sent its fourth order for Cross oil filters to the Burt Mfg. Co., Akron, Ohio.

OHIO ELECTRIC WORKS, Cleveland, have just issued a new catalogue of electrical novelties which they are mailing to the trade. Copies will be sent on receipt of address

THE BALL ENGINE COMPANY, Erie, Pa., has received an order from the American Steel Foundries, of Indiana Harbor, Ind., for a 300-hp direct-connected Ball engine unit.

J. G. WHITE & COMPANY, engineers, etc., have removed their offices to the twenty-second floor of the Wall Street Exchange Building, 41 to 43 Wall Street, and 43 and 49 Exchange Place, New York.

THE SUMTER TELEPHONE MANUFACTURING COMPANY, of Sumter, S. C., has recently completed a large addition to its already prosperous plant. Several new types of instruments will shortly be turned out.

MR. W. ROCHE, the dry battery manufacturer, 42 Vesey Street, New York City, had a severe visitation from fire last week, when considerable damage was done to stock and building. Business will be carried along as usual.

THE ZENITH LAMP is made by the Packard factory and sold by the Electric Appliance Co., Chicago. It is strictly an incandescent lamp, yet may be named as a type of its own as an intermediate illuminant between the arc and incandescent. Booklets, illustrating this lamp, which is a most marked advance in lighting, will be mailed promptly for the asking.

CHASE-SHAWMUT COMPANY, of Boston, notes the removal of its factory to Newburyport, Mass., where it will have greatly increased facilities for manufacturing. A large stock of its standard product in electrical specialties will be carried by its agents, Stuart-Howland Company, Boston; W. S. Brown, New York; Thos. G. Grier Company, Chicago; John R. Cole, San Francisco.

ELECTRICITY VS. GAS.—The Wagner Electric Mfg. Company, St. Louis, has issued a very neat little pamphlet giving the true story of an electric light company which was "knocked out" by Welsbachs, but which turned the tables on its gas competitor by piling up a big power load in the daytime. The points are well made and are full of suggestion to those who have not yet developed a power business.

THE HEWITT MERCURY VAPOR LAMP is the subject of a very interesting illustrated pamphlet issued by the Cooper Hewitt Electric Company, of 220 West 29th St., New York City. A number of types and designs are shown, including the new tilting lamp illustrated lately in these pages. A number of testimonials are given as to the excellent results obtained by photographers and others. The current consumption is given as .4 and .3 watt per spherical candle.

ELECTRIC GAS LIGHTING COMPANY, 195 Devonshire Street, Boston, Mass., has recently entered the telephone field, to supply apparatus as well as its well-known batteries, and has issued a handsome catalogue on the subject, which illustrates and describes a large variety of "Samson" transmitters, receivers, bells, intercommunicating systems, etc. Full details of construction, prices, etc., are given.

PITTSBURG TRANSFORMER COMPANY, of Pittsburg, Pa., has issued a circular in which it gives a letter from Mr. H. W. Hamblin, general superintendent of the Nassau Light & Power Company, of Roslyn, L. I., to Mr. A. H. Mustard, sales agent in New York City, testifying as to the remarkable and splendid results obtained with these transformers, of which he has 300, ranging from 1-kw to 50-kw. The endorsement of a practical man could not be more emphatic.

HAZARD MFG. COMPANY, of Wilkesbarre, Pa., has just issued a new catalogue of its wire rope, a specialty by which it was known long before it entered the field of insulated wire manufacture. Wire rope was made as far back as 1848 in this country by men who afterwards formed the Hazard Company, and the product thus named has always enjoyed a high reputation. The new catalogue brings to notice also a variety of detail and auxiliary apparatus and material.

THE CENTRAL ELECTRIC COMPANY, Chicago, has just issued its November price-list and discount sheet, copy of which ELECTRICAL WORLD AND ENGINEER desires to acknowledge. It is an exceedingly attractive little book, designed to supplement its 1903 general catalogue. It has been revised to date and contains the very latest prices in force, hence cannot help but be of interest to every one in the electrical field. Every holder of a catalogue who has not received this price-list should write for one.

BUFFALO FORGE COMPANY, Buffalo, N. Y., have just issued a new catalogue on mechanical draft apparatus. It embodies a variety of interesting data and material, as well as some illustrations of outfits installed by the concern. The tables included give the capacities of fans for induced draft under average working conditions as well as the theoretical output with unrestricted inlet and discharge. The pamphlet, which can be had on application, illustrates also the Buffalo fan system of heating, ventilating and drying apparatus.

TRUMBULL ELECTRIC MFG. COMPANY, Plainville, Conn., has recently brought out a neat flush receptacle different from other receptacles in that it fits the standard switch boxes and takes any Edison base attachment plug. No special plug is necessary. Any Edison screw base that has ever been used for a desk lamp or a fan can be used in this receptacle. It has a nickel-plated cover. The Trumbull Company has also issued excellent bulletins as to its switches of various types, rosettes, sockets, cut-outs, connectors, etc., all well made, durable and low in price.

PEERLESS RUBBER MFG. COMPANY, 16 Warren Street, New York, has issued in Catalogue No. 60 a splendid summary of the state of the art in miscellaneous rubber goods for mechanical and industrial purposes. It is a book of 150 pages, handsomely printed in black, red and other colors not merely for ornament but to bring out the goods as they actually appear, as, for example, the packings and mattings or tilings. Some idea of the range covered by the pamphlet may be formed from the fact that no less than 47 trade marks controlled by the concern are enumerated, and many of these are familiar to everybody in the electric light and power field. The fullest information is given as to all the specialties and some of it is quite interesting as, for instance, that in regard to the origin of "Rainbow" packing. The goods are also beautifully illustrated.

STANDARD ELEC. MFG. COMPANY, of Niles, Ohio, the maker of the Star incandescent lamp, has issued a remarkably handsome catalogue devoted to its lamp specialties. The cover is most ingenious, showing a Star lamp hanging in the center, in high relief, to which around the borders of a large panel run wires represented by yellow silk threads held down by cleats. The effect is very novel and pleasing. The contents of the pamphlet are devoted to a discussion of the features of the lamp—vacuum, filament, voltage, etc., and varieties of standard, round, railway, white, miniature and other types are richly illustrated. A feature of this brochure, which is likely to be preserved by all who get it, consists in the beautiful illustrations of scenes and buildings in which the incandescent lamp figures decoratively, and many artistic fixtures are also depicted.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCTOBER 27, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

742,195. HEAT ALARM; Howard Field Jones, Wilson, N. C. App. filed Feb. 3, 1903. Contacts are applied to a thermometric device to close an alarm circuit when the temperature rises or falls to a certain point.

742,280. ELECTRIC MOTOR; Joseph H. Blair, St. Louis, Mo. App. filed March 21, 1903. A centrifugal device for short-circuiting the armature coils when an alternating current, self-starting, single-phase machine reaches full speed.

742,287. MASSAGE INSTRUMENT; Louis Casper, Chicago, Ill. App. filed June 4, 1901. A tubular belt containing liquid has a flexible wall which receives the strokes of a vibrating hammer, thus communicating the shocks through the liquid to all parts of the body embraced by the belt.

742,298. COHERER FOR WIRELESS TELEGRAPHIC SYSTEMS; Louis Dorman, Washington, D. C. The coherer comprises a globule of mercury having a coating of oil and a finely divided mineral substance.

742,305. BLAST CONTROLLING DEVICE FOR DENTAL OR OTHER USES; Nathan K. Garhart, Indianapolis, Ind. App. filed April 17, 1903. An electrical heater is inserted in a tube through which a blast of air is directed; the air can flow hot or cold, depending upon whether the circuit of the heater is opened or closed.

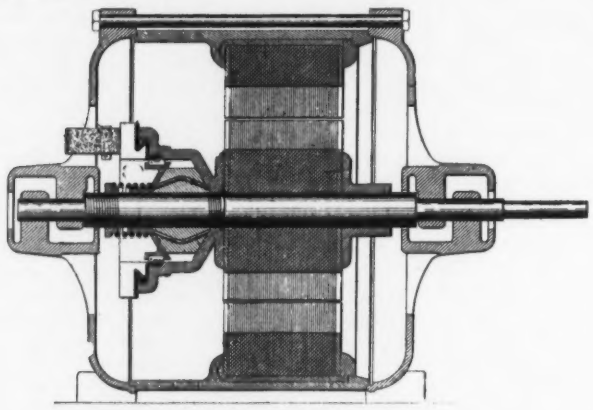
742,309. ELECTRICALLY ILLUMINATED SIGN; John H. Goehst, Chicago, Ill. App. filed May 12, 1902. A nut screws externally upon the receptacle and clamps the thin metal face of the sign in an opening in which the receptacle is located.

742,310. ELECTRIC CAR HEATER; Edward E. Gold, New York, N. Y. App. filed Feb. 26, 1903. A heat deflecting plate is arranged under the seat and a number of heaters are mounted common to a single plate.

742,311. TROLLEY FINDER; Fred A. Graham, Ferdinand F. Carmiencke and John R. Neely, Muncie, Ind. App. filed Jan. 30, 1903. A rotary spiral track each side of the trolley wheel conveys the displaced wire to the wheel.

742,331. CASING FOR TROLLEY WHEELS; Thomas Kelch, Newport, Ky. filed Feb. 2, 1903. A casing in which one side is hinged to allow the wheel to be removed and replaced.

742,348. ELECTRIC POCKET FOR LIGHTING PURPOSES; Alexis Olenin, New York, N. Y. App. filed March 28, 1902. A plug entering the pocket acts as a wedge upon the blades of a knife-switch and closes the same.



742,280.—Electric Motor.

742,374. CIRCUIT CONTROLLER FOR SURGICO DENTAL ENGINES; William W. Alexander, Kansas City, Mo. App. filed Dec. 24, 1902. Details.

742,378. TROLLEY CONTACT DEVICE; Wallace L. Baker, Painesville, Ohio. App. filed Dec. 29, 1902. Springs are arranged to hold the wheel in a normal position, but permit it to tilt when necessary.

742,398. HANGER FOR ELECTRIC LAMPS OR THE LIKE; Michael C. Donahue, Colorado Springs, Colo. App. filed May 1, 1902. Details of a take-up spool for flexible cord.

742,407. ELECTRIC ADVERTISING; George W. Enright, New York, N. Y. App. filed March 4, 1902. Receptacles are mounted in monogram form and a given letter is selected by placing a pattern sheet over the monogram containing openings that admit lamps at places to form only the desired letter.

742,408. ELECTRODYNAMIC EQUIPMENT FOR SCHOOLS; Horace J. Evans, Wausau, and Tracy B. Hatch, Menominie, Wis. App. filed Aug. 5, 1903. An assemblage of apparatus consisting of supports, pole shoes, magnets, commutators and other parts, arranged to be assembled as desired and knocked down at will for the purpose of teaching the principles of electricity and electro-dynamics.

742,426. ELECTRIC CARRYING APPARATUS; John J. Hill, Rose Mills, Va. App. filed June 22, 1903. Details of a parcel carrier system.

742,449. QUICK BREAK SWITCH; Hubert Krantz, Brooklyn, N. Y. App. filed June 4, 1903. A block of insulating material carrying a blade on each side hinged to one pair of terminals, has a handle pivoted to it and also connected by a spring which is put under tension when the handle is lifted to finally quickly remove the blades from the clips.

742,453. SPLIT ELECTRICAL CONDUIT; Edward N. Lake, Chicago, Ill. App. filed April 25, 1903. The conduit is split longitudinally, the parts being laid together as required.

742,487. ELECTRIC SIGNALING DEVICE FOR RAILWAYS; Hubert Pfirmann, Frankfort-on-the-Main, Germany. App. filed Dec. 7, 1901. Details.

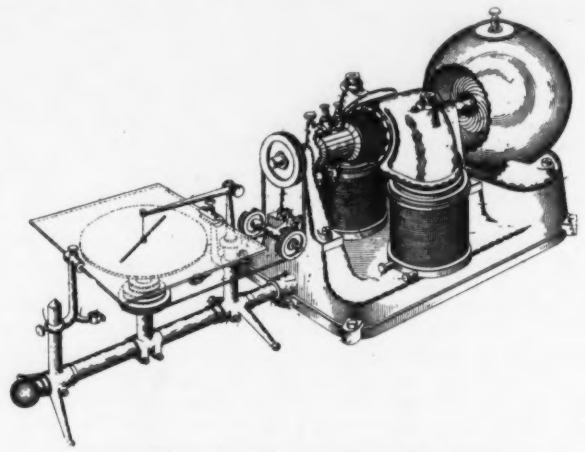
742,499. ELECTRIC FUSE SWITCH BOX; Joseph Sachs, Hartford, Conn. App. filed March 19, 1901. A casing having fixed terminals and a hinged cover having a clamp for an inclosed fuse; when the cover is closed, the fuse acts as a switch element to close the circuit across the fixed terminals.

742,508. PUSH BUTTON SWITCH; Alexander B. Simpson, New York, N. Y. App. filed July 9, 1903. Details.

742,547. ELECTRICAL SWITCHING SYSTEM; Golbert Wright and Francis V. Nicholls, Pittsfield, Mass. App. filed Feb. 16, 1903. The mechanism comprises a hand-switch, the condition of which serves as an indicator of the integrity or defectiveness of the circuit.

742,548. TRANSFORMER; Golbert Wright, Pittsfield, Mass. App. filed Feb. 20, 1903. A transformer comprising a central core, U-shaped radiating magnetic yoke-sections arranged around the core and primary and secondary coils encircling the core and embraced between the arms of the yoke-sections.

742,551. WIRE CORE MACHINE; Thomas A. Aiton, New York, N. Y. App. filed May 4, 1903. A machine adapted to wrap two or more telephone or other wires with strips of insulating material and at the same time twist the wrapped strands together to form a core.



742,408.—Electrodynamic Equipment for Schools.

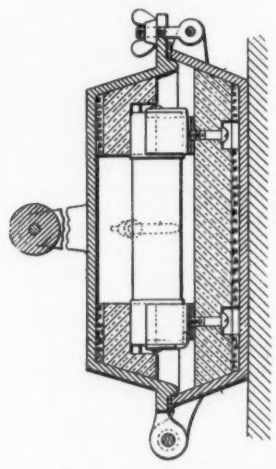
742,600. DYNAMO ELECTRIC MACHINE OR MOTOR; Edwin R. Cox, Jr., Birmingham, Ala. App. filed Aug. 21, 1903. A uniform-field dynamo or motor, comprising oppositely excited pole pieces electrically insulated from each other and rotary armature disks co-operating with the pole pieces and in electrical connection with each other and with the respective pole pieces whereby the armature currents are conducted to and from the machine through the metal body.

742,604. ELECTRIC ARC LAMP; George R. Davison, Pittsfield, Mass. App. filed Feb. 16, 1903. The wire connection between the movable carbon rod and the electro-magnet is prevented from becoming entangled by a guide through which it passes.

742,661. ELECTRIC LIGHTER; Conrad Hubert, New York, N. Y. App. filed May 8, 1902. For igniting a cigar-lighting torch, the electric terminals are placed in a tube having draft openings below and above and a port to admit the end of the torch to the terminal.

742,681. AUTOMATIC INDICATOR; Wesley E. Laird, Pittsfield, Mass. App. filed Jan. 13, 1902. Consists of apparatus adapted to measure the electrical condition at a given point in a circuit and to transmit to a distance definite signals corresponding with such measurements, together with means controlled from a distance for setting the apparatus in operation.

742,705. ELECTRIC ARC LAMP; Joseph Melzer, Cleveland, Ohio. App. filed April 10, 1901. Details.



742,499.—Electric Fuse Switch Box.

742,706. ELECTRIC ARC LAMP; Joseph Melzer, Cleveland, Ohio. App. filed Jan. 2, 1903. A prominent feature of this lamp is that the magnet which operates the carbon clutch is arranged and adapted to act as the choking coil.

742,725. ELECTRIC LAMP SOCKET; Mortimer Norden, New York, N. Y. App. filed Feb. 24, 1903. A cup member and a base member forming a receptacle, the two parts being held together by screws passing from one into the other and at the same time engaging with the metallic plates carried by each part, so that the circuit will be closed from the main conductors through the plates and screws to the lamp terminals.

742,743. COMMUTATOR; Christopher J. Roach, Hartford, Conn. App. filed June 27, 1903. The armature terminals are detachably connected with the commutator segment, so that the commutator can be removed without disturbing the armature coils.

742,814. SURGICAL APPLIANCE; Albert V. Todd, Denver, Colo. App. filed Aug. 3, 1903. Details.